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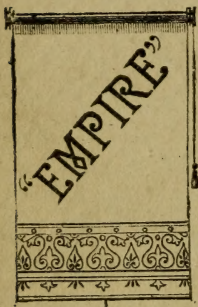

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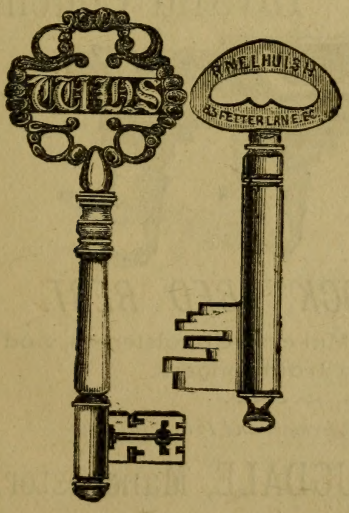

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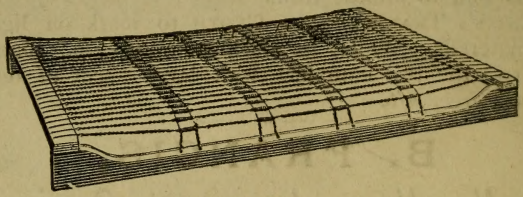

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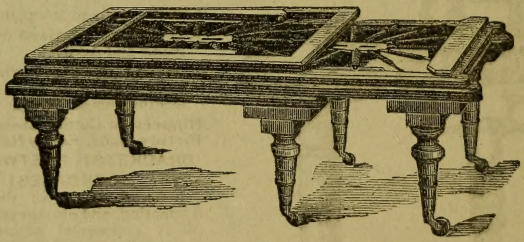

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"Come hither,
Nor fear lest danger lurks; but firmly stand,
And look adown the waters. Beauteous plants
Quiver and sparkle; and methinks bright hues,
E'en such as Iris flings on watery floors,
Are seen among them."

PREFACE.

Among the ever-alluring and delightful studies of Nature, the pursuit of Marine Botany is worthy of holding a higher place than it has yet attained. It is entitled to rank, not merely as a science appreciated only by the few, but to be rendered subservient to the moral and intellectual culture of the many. True, it is a study from which a great proportion of mankind must be practically excluded, by their remote residence from the shores upon which the treasures of the mighty ocean are to be found; but in these times, when, upon the approach of the summer months, tens of thousands quit the smoky confines of sunless towns and cities, to breathe the bracing air and bask in the unbroken sunshine of the sea-coast, there is ample opportunity for gratifying the love of Nature by turning to those of her attractive works which to many, in ordinary circumstances, are shut out from investigation.

In this Handy Book we have devoted a willing service to the thousands who, in coming summers,

may go out to the coasts of their native land, to watch the silvery waves dancing upon the rocky or the pebbled shores, and to gather the gems which these bright waves are ever casting at the feet of the beholder, or leaving exposed to the view, as in their diurnal courses they recede from the higher boundary of their approach.

To the careless observer there is nothing attractive in the tangled lines of "sea-weeds" which are seen rolling about under the lashing of the white surf: but let such a person once "stoop to conquer" the fault of indifference, and he will be rewarded by the discovery of gems which, the more he scrutinises, the more he will admire; and it is the purpose of our book to lead him on from step to step in a pleasing pursuit, until at last he will wonder that he has so long neglected the treasures which lay inviting his inspection.

HANDY BOOK

OF

MARINE BOTANY.

CHAPTER I.

By botanists, these sea-weeds are termed *Algæ*; a name which is applied to a large group of flowerless plants, and which form the vegetable kingdom of the waters. "The sea, in no climate from the Poles to the Equator, is altogether free from them, though they abound on some shores much more than on others. Species abound likewise in fresh water, whether running or stagnant, and in mineral springs. The strongly impregnated sulphureous streams of Italy, the eternal snows of the Alps and arctic regions, and the boiling springs of Iceland, have each their peculiar species; and even chemical solutions, if long kept, produce Algæ. Very few, comparatively, inhabit stations which are not submerged, or exposed to the constant dripping of water; and, in all situations where they are found, great dampness, at least, is necessary to their production."

One great advantage in the study of the marine Algæ is, that they may be laid out upon paper and dried, in which state of preservation they will display, with beautiful effect, their various peculiarities of structure and colour. They may, when thus preserved, be placed into books, and become admirably adapted for the drawing-room or parlour table, and when arranged, with their proper names and the dates and situations where they were found annexed to them, they serve as most pleasing memorials of "moments of sweetness past," upon which the fond memory may delight to dwell. We encourage, therefore, all who may peruse this little work, and who may have opportunity of collecting

the marine Algæ, to commence this pleasing pursuit at once, or at their earliest convenience, and to make the recreation of collecting specimens collateral with their study of them. We are confident that they will be greatly delighted as they proceed; and to make the pursuit the more agreeable, we shall do our very best to strip it of the chief difficulties by which it has hitherto been beset. It is our intention to give the classical names and arrangement of all the series, families, and individuals, of the Algæ; to give, as well as the classical, the *familiar* names; to intimate, also, the pronunciation of the Latin names employed; to furnish an engraved illustration of one or more individuals of each family; and to supply such other information as our own experience has taught us to consider most desirable for the beginner, and which, from the paucity and dearness of works upon this subject, cannot easily be obtained elsewhere.

In Harvey's Manual (from which we have already quoted), we are informed that the Algæ, growing in the depths of the great Pacific Ocean, have stems which exceed in length (though not in diameter) the trunk of the tallest forest trees; and others have leaves that rival in expansion those of the palm. Some are simple globules and spheres, consisting of a single cellule, a little bag of tissue filled with colouring matter; some are mere strings of such cellules, cohering by the ends; others, a little more perfect, exhibit the appearance of branched threads; in others, again, the branches and threads are compound, consisting of several such threads joined together; and in others the tissue expands into broad flat fronds (leaves).

In colour, the Algæ exhibit three principal varieties, with, of course, numerous intermediate shades, namely, grass-green, olivaceous, and red. The grass-green is characteristic of those found in fresh water, or in very shallow parts of the sea along the shores, and generally above the half-tide level, and is rarely seen in those which grow at any great depth. But to this rule there are excep-

tions. The olivaceous brown, or olive-green, is almost entirely confined to marine species, and is, in the main, characteristic of those that grow at half-tide level, becoming less frequent towards low-water mark; but it frequently occurs also at greater depths, in which case it is very dark, and passes to brown, or almost black. The red, also, is almost exclusively marine, and reaches its maximum in deep water. It is rarely very pure much within the range of extreme low-water mark, higher than which many of the more delicate species will not vegetate; and those that do exist, degenerate in form as well as in colour, as they recede from it. The green species are of the simplest structure. The olivaceous are the most perfect and compound, and reach the largest size; and the red form a group distinguished no less by the beauty and delicacy of their tissue, than by producing seeds under two forms, thus possessing what is called double fructification.

In the wise economy of nature, the Algæ are employed to purify the waters, as plants purify the air; they also serve as food and shelter for various species of marine animals, which in their turn become food for larger animals, and for man. They are also employed for manure, for which use they are, in many parts, and especially on the coasts of Ireland, considered of the utmost importance. Some kinds of Algæ have been employed as food for man; others as medicines; and from one of the tribes *kelp* is obtained—an article used in the manufacture of glass and soap. It is probable that these vegetables are capable of being applied to many useful purposes yet undiscovered; and the study of Marine Botany may tend to enhance their value.

DIRECTIONS FOR COLLECTING AND LAYING OUT SEA-WEEDS.

It must be borne in mind, that if exposed to the sun or rain, the plants, as a general rule, soon change colour. The gleaner should, therefore, always seek for them at low tide,

in pools among the rocks, where the finest specimens may be found. It should be noticed whether they were found growing from, or attached to the rocks, or whether they were accidentally left there by the falling tide. Specimens which are found attached to the rocks will almost invariably be the most perfect; and care should be taken to obtain the entire plant, raising with it the tendrils by which it holds to the stone. When gathered, the sooner they are laid out the better. Miss Gifford* gives the following instructions:—"First wash the sea-weed in fresh water,† then take a plate, or dish [the larger the better]; cut your paper to the size required, place it in the plate with fresh water, and spread out the plant with a good-size camel-hair pencil in a natural form (picking out with the pin gives the sea-weed an unnatural appearance, and destroys the characteristic fall of the branches, which should be carefully avoided); then gently raise the paper with the specimen out of the water, placing it in a slanting position for a few moments, so as to allow the superabundant water to run off; after which place it in the press. The press is made with either three pieces of board or pasteboard. Lay on the first board two sheets of blotting-paper; on that lay your specimens; place straight and smooth over them a piece of old muslin, fine cambric, or linen; then some more blotting-paper, and place another board on the top of that, and continue in the same way. The blotting-paper and the muslin should be carefully removed and dried every day, and then replaced; at the same time those specimens that are sufficiently dried may be taken away. Nothing now remains but to write on each the name, date, and locality. You can either gum the specimens in a scrap-book, or fix them in, as drawings are

* "The Marine Botanist."

† Our own experience leads us to believe that clean salt-water, where this can be obtained, is much the best. We have found that the plants lose colour by being immersed in fresh water, even for a short time. Water and salt is better than fresh water.

often fastened, by making four slits in the page, and inserting each corner. This is by far the best plan, as it admits of their removal, without injury to the page, at any future period, if it be required either to insert better specimens, or intermediate species. Some of the larger Algæ will not adhere to the paper, and consequently require gumming. The following method of preserving them will be found one of the best:—"After well cleaning and pressing, brush the coarser kinds of Algæ over with spirits of turpentine, in which two or three small lumps of gum mastic have been dissolved, by shaking in a warm place; two-thirds of a small phial is the proper proportion, and this will make the specimens retain a fresh appearance."

CHAPTER II.

To the shores! where the bright green sea
Its snowy spray is throwing.
Down by the mystic-looking caves,
Where healthful winds are blowing.
There, cull the treasures of the deep,
Where gems of pearly beauty lie,
Where sea-birds their carousals keep,
Chiding the stranger wand'ring by.

The sea! the sea! its lonely shore,
The billows crested white;
The clouds that flit its bosom o'er,
Or sun-beams dancing bright:
The breakers bursting on the strand
In thunders on the ear:
The frowning cliff, the silvery sand,
Each, all, to me are dear.

"THE sea! the sea! the deep proud sea!" what treasures are concealed in its fathomless recesses! Who, in walking beside its shores, does not recall to mind the

awe and wonder with which he first beheld the onward rushing of giant billows, till suddenly subsiding at his feet they spread upon the sand those beautiful sea-weeds which children often seize in their small hands, dripping with the brine of the ocean, and run joyfully to show their companions!

There is a freshness in ocean scenery which has few parallels except in mountainous countries. There is no sameness on the surface of the deep, for no two billows are alike either in form or hue; and yet their power to delight the mind consists in unity, and in a kind of fellowship with the elements of air and light by which they are surrounded. Hence the infinite variety of varying shadows cast by rapid clouds while speeding through the heavens; the restless heaving of the waves, with their crests of foam sparkling on the sunbeams; their majesty when tempests are abroad; their calm and gentle swell when zephyrs are sporting on the deep. But how much is the effect heightened, and what subjects of deep interest are awakened in the mind, when the whole is regarded with reference to that vegetable world which lies deep beneath the billows, specimens of which the waves continually bring up, as if commissioned to make known the wonders of creation in places inaccessible to man.

Let us, then, go forth, whether as children or young people, or those to whom Marine Botany is familiar, and collect sea-weeds on the shore. Cicero left us an example which we may do well to emulate. He draws a delightful picture of the pleasures derived from such pursuits by Scipio and Lælius at Laurentum, when, having relinquished for a time the cares attendant on public life, they amused themselves with observing the various productions that were cast by waves upon the sand.

But first, as needful for an enlarged view of this interesting subject, it will be right to speak concerning the local appropriation of different species, for such appropria-

tion equally exists beneath the waters as on land. Fewer divisions undoubtedly there are, because sea plants, unlike those of terrestrial rock or soil, are not liable to be affected by atmospheric changes; the sun does not scorch them during summer, nor may the frosts of winter depress their vital energy; and hence it happens that sea-weeds are more uniformly dispersed.

The vast extent of ocean greatly facilitates such a general dispersion. Land plants are continually impeded in their progress by intervening seas, or rivers; marine plants rarely by land barriers, although the number of tribes into which marine botanists have divided the family of Algæ are very numerous, and their watery stations singularly varied. Those stations, as far as the researches of indefatigable naturalists extend, have each an especial reference to the character and mode of growth pertaining to aquatic plants, or to the necessities of such marine animals or shell-fish as harbour among them. Numerous species remain stationary, growing on the stony bed of ocean, or clinging to the rocks —others become attached to the shells of crustaceous or testaceous wanderers, and travel with them—others, again, float hither and thither, having no abiding-place.

"Hung from the rock, on ocean's foam to sail,
Where'er the surge may sweep, the tempest's breath prevail."

Such plants range through various geographical regions of aquatic floras, being found deposited on the shores of countries separated by the "liquid weight of half the globe," as, for example, those of Europe and the United States; of Cape Horn and of Van Diemen's Land. Among species strictly antarctic, Dr. Hooker identified not less than a fifth-part of the whole species common to the British seas. This eminent naturalist suggested, that cold currents, which prevail from Cape Horn to the Equator, and are there met by other streams of similar temperature, may, by their direct influence, as well as temperature, facilitate the pro-

gress of antarctic species to the Arctic Ocean, and that the migration of different marine animals from south to north may have been produced by the same cause.

Botanists assign ten separate provinces to the family of Algæ:—

1st. The North Circumpolar, extending from lat. 60 N. to the Pole: and including that wild and restless sweep of ocean which embosoms Iceland and Spitzbergen, and laves the coast of Norway and Lapland, of Nova Zembla and Greenland, with such as form the northern boundaries of the Russian empire—an ocean hoary at one season of the year with mountains of floating ice, that reflect the dazzling beams of the sun, or else exhibit the appearance of innumerable spangles flying off from their wavy surface; and where, during winter, the waves are congealed towards the Pole into a solid mass.

2nd. The North Atlantic, or the region of *Fucus* proper, and Delesseriæ. This wide region extends from lat. 40 N. to lat. 60 N.; it comprises Nova Scotia and Newfoundland, with the shores of cold and pitiless Labrador, and the extreme point of Cape Farewell. Voyagers speak of a remarkable accumulation of that species of sea-weed generally known as the Gulf-weed, or *Sargassum*, which occurs on either side of the Equator. Columbus, when steering due west, nearly in the same latitude as the Canary Islands, and about 400 leagues distant, observed a similar phenomenon: he found the sea so covered with weeds that it resembled a meadow of vast extent, and, in some places, such was their strength and number as to retard the motion of the vessels.

Rennell, to whom we are indebted for much valuable information relative to the North Atlantic Ocean, speaks of the Gulf Stream as producing a remarkable effect on its climate, consequently, on its aquatic flora. This most powerful of known currents has its source in the Gulf of Mexico, which, like the Mediterranean Sea, and such as are encompassed

with land in temperate or low latitudes, is warmer than the wide ocean in similar parallels. Hence, during summer, the temperature of the Mexican Sea, according to the same observer, is 86 deg. Fahr., or at least 8 deg. above that of the Atlantic. From this great reservoir, or cauldron, of warm water, a constant current pours forth through the Straits of Bahama, at the rate of three or four miles an hour, crossing the ocean in a north-easterly direction, and skirting the great bank of Newfoundland, where it still retains a temperature of 8 deg. above that of the watery plain through which it flows. Onward goes that current, with the same unerring precision, following a prescribed course, and swerving neither to the right nor left for nearly three thousand geographical miles, till having reached the Azores in about seventy-eight days from its source in the Gulf or Sea of Mexico, it sometimes extends its progress a thousand miles further, to the Bay of Biscay, retaining an excess of 5 deg. above the mean temperature of that sea Nor less curious is the fact, that this oceanic river reaches the Bay of Biscay in the months of November and January, and tends, most probably, to moderate the cold of winter in countries on the west of Europe.*

Hooker traced the *Fucus nodosus* and *Fucus serratus* on the northern edge of this vast current, from lat. 36, to England. At that point also, in the centre of the North Atlantic, between the parallels of 33 deg. and 35 deg., which Rennell terms the recipient of its heated waters, spreads the *sargosso*, *sargassum*, *bacciferum*, in incredible profusion. Voyagers relate that it is seen floating and sparkling in the sun-beams, and presenting an exquisite variety of mingling hues.

3rd. The region of the Mediterranean, which may also be regarded as a sub-region of the 4th, or warmer temperate zone of the Atlantic, between lat. 23 N. and lat. 40 N.

* Rennell on Currents.

This temperate region is sprinkled over with the thickly-scattered isles of Greece, and many a classic spot,

> 'Which seen from fair Colonna's height,
> Makes glad the heart that hails the sight,
> And lends to loneliness delight,
> Where mildly dimpling ocean's cheek,
> Reflects the tints of many a peak
> Caught by the laughing tides that lave
> These Edens of the eastern wave."

5th. The Tropical Atlantic, in which *sargassum*, *rhodomelia*, *corrallinea*, and *siphinea* abound.

6th. The South Atlantic, that vast extent of ocean which extends from the coasts of South America to those of Africa. In this division the *fucus* reappears. Throughout its might of waters passes also that portion of the Gulf Stream which Rennell designates as the South Atlantic current, varying in its rapid course of twenty-five to seventy-nine miles daily, in its breadth from one hundred and sixty to four hundred and fifty miles, the length of its whole course being one thousand miles, till lost in the Caribbean Sea. A current so vast and deep, that the same accurate observer characterizes it as an oceanic river, having a rapidity exceeding that of the largest navigable rivers; and so deep as to be occasionally turned aside by subaqueous banks or mountains, which yet do not rise within forty or fifty, or even one hundred, fathoms of the surface.

And yet, however botanically divided into different regions, with their dissimilar floras, one singular fact pertains to the Atlantic—namely, the absence of coral reefs, either on the west coasts of Africa, or among the islands of the Gulf of Guinea, around St. Helena, or Ascension, Cape Verde, or St. Paul's. With the solitary exception of Bermuda, there is not a single coral reef in the central expanse of the Atlantic, although some portion of its waters, as at Ascension, are charged to excess with calcareous matter.

This curious fact is probably owing to the absence of fit stations for the reef-building polypifers; other organic beings in those regions obtaining, in the great struggle for existence, a mastery over them.*

7th. The Antarctic American, comprehending from Chili to Cape Horn, the Falkland Islands, and thence round the world south of lat. 50 S.

8th. The Australian and New Zealand, of which the marine productions are equally peculiar with such as vary the hills and plains of those recently-discovered countries.

9th. The Indian Ocean and Red Sea, with their infinite variety of coral reefs and islands.

10th. The Chinese and Japanese seas, in addition to which, there are yet a few not well defined, and which especially pertain to the Pacific Ocean.

Such are the ten divisions into which botanists have divided the world of waters, each with its peculiar growth of Algæ; but while regarding this interesting portion of our subject, it must ever be borne in mind that in subaqueous, equally with terrestrial plants, the distinctiveness between the provinces relates strictly to species, and not to forms. Nor less worthy of observation is the recently-established fact, that, with regard to the numerical preponderance of certain forms and peculiarities of internal structure, a marked agreement is generally perceptible in the vegetable productions of aqueous provinces, placed in corresponding latitudes and under similar physical circumstances, however remote their position. Sea-weeds on the shores of the Brazils, Equinoctial Africa, and India, present innumerable points of analogy. Few species, however, of subaqueous plants are common to the seas of Van Diemen's Land, New Zealand, and Fuegia, but a great number of genera, and among these, some few confined to the above-mentioned regions of the southern hemisphere, are severally repre-

* Principles of Geology, by Charles Leyell.

sented in distant seas by a single species. Naturalists further observe that such plants as seem indigenous throughout the waters of the southern temperate regions, as well as those of the Antarctic, possess each a representative of genera belonging to analogous climates in the opposite hemisphere, but that very few of the species are identical, unless belonging to families of universal diffusion.

Were it possible to stand on the margin of some bold coast, and look down through the ocean, when spreading like a mirror in its beauty and serenity, what magnificent subjects for contemplation would be everywhere discerned. Take, for instance, the German Ocean, traversed by an enormous bank, which occupies a central position, and extends from the Frith of Forth in a north-easterly direction, to at least one hundred miles; while other banks or ridges stretch from Denmark and Jutland towards the north-west, and the Dogger-bank lifts its rugged surface, Alp-like, with deep ravines, covered by an aquatic flora.

The bed of ocean everywhere presents an equal variety of rocks and hollows, yet varying in their character and productions. Algæ, emulating in height the most stately forest trees, overshadow the watery valleys of the vast Pacific. Where the sea is calm, beautiful sea-weeds of the most delicate hue and colour grow luxuriantly like meadow-grass; where, on the contrary, the shores are rocky, and covered with impetuous waves, their natural productions are often parasitic, and fix themselves among the stones with a tenacious grasp.

To an eye that could embrace the abyss of ocean, scarcely might the vicissitudes of day and night, the motion of the stars, the glorious sun, or milder moon, seem more worthy of regard than the order that prevails beneath the world of waters. There the coral insect works her wonders, subservient to laws that never change, and having prescribed limits over which she may not pass; and mighty rivers rushing from their channels to the sea, pour over

those plains and valleys which never receive a ray of light, but through the medium of water, large supplies of pebbles, sand, or soil, adapted for the growth of dissimilar plants. Clear and bubbling streams rise from out the bed of ocean, while, beside them, crowd such floras as delight in their purity and freshness. And, punctual to their appointed season, come and go those ever-moving tides, which, like the winds of earth, have a mighty purpose to fulfil, a ministry which the power of man can neither frustrate nor hasten.

CHAPTER III.

MELANOSPERMEÆ.—OLIVE-GREEN SERIES.

Is there a quiet world that lies beneath
The might of waters, sounding, moving ever;
Or rough with storms, or thundering on the shore
With deaf'ning clamour? Yes, a quiet world
Doth lie beneath, with groves, and vales, and streams,
And living creatures, each with haunt and home,
As best befits it.

MARINE Botany peoples the wild sea-shore, and sings to me strange histories and adventures; even the smallest sea-weed which the waves have brought from out its ocean-bed whispers concerning depths which no human eye has seen, nor the boldest adventurer ever trod. Plants, such as grow beside our paths, have their own brief histories; memorials too are they, ofttimes, of days long past, associated with old times, and men whose stern adventures formed an era in their fatherland: but such is not the case with those of which we speak. The brine of ocean is on their dripping leaves; no shadows rest on them from ancestral trees, wav-

ing over lost homes or graves; nor yet the shadows of crowding houses, where life and death alternate as years pass on. Shadows, indeed, they have, such as clouds may shed when speeding through the heavens, or hurrying billows fling in passing—but these are beautiful.

The *Fucus nodosus*, largest of British Algæ, speaks to me of tempest-driven mariners, who, having kindled a fire on the sands of Bœotia, with sea-weeds cast by the waves on shore, found among the extinguished embers a strange substance, which, in after years, opened to the naturalist a miniature world, populous and full of wonders as that by which we are surrounded—a substance which assists the astronomer in discovering new suns and systems, and numbering the stars of the milky way; or, in its most simple and direct appropriation, enables the inhabitant of Britain to cultivate exotic fruits and flowers.

Yet, such is the result of that accidental circumstance; and kelp, manufactured from the *Fucus nodosus* and *Canaliculatus*, with others of their kind, forms an invaluable ingredient in making glass. Observe that group of marine plants growing on tide-washed rocks, and what do you see in them but luxuriant developments of vegetable forms —the first, especially, with ample fronds of dull olive-green, tastefully contrasted with greenish-yellow receptacles, supported on slender stalks, each receptacle filled with a gelatinous substance, and traversed by a net-work of jointed fibres.

Chemistry reveals that those wild sea-plants contain carbonate of soda, mixed with sulphate and muriate of the same alkali, and combinations of iodine. History records that scarcely a hundred years have passed since plants of the same kind were left unnoticed, till an enterprising individual taught his countrymen to prepare them for purposes of commerce. But some there were who, wedded to old habits, protested that their ancestors had never thus employed them; and when kilns were erected, and people induced by high wages to

collect and burn the sea-weeds, clamours were succeeded by violent opposition, till at length it became necessary that officers of justice should be sent to protect the workmen. Trials ensued, and advocates pleaded gravely that the suffocating smoke produced by burning sea-weeds would destroy the sheep and cattle, and drive away the fish. Yet, still the work progressed, and estates well bordered with sea-weeds increased so much in value, that, where the plants did not grow naturally, attempts were made to cultivate them, by covering the sandy bay with large stones.

Who is there that does not often vividly remember the season of hay-making amid the din and stir of thronged streets, or on far-off shores? With equal vividness the native of the Orkneys recalls to mind the time of cutting weeds on his own bold coast, even if his lot be cast in regions where the drifting sea-weed has alone aught in common with the vegetable productions of a stranger clime. Imagine one of those wild spots where the restless waves, having laid aside their fierceness, and hushed their loud clamours, sport merrily among the rocks, rippling and sparkling, and tossing their crests of broken foam; now covering the meadows of sea-weeds, and again receding, till the dripping fronds, shaken by the breeze of ocean, reflect innumerable prismatic colours. Men are there, who step from stone to stone among the weeds, and lay them low—as mowers the ripe grass: women, too, who collect them in bundles; and children, all glee and gossip, who joyfully aid their parents, and pick up such straggling branches as are left upon the sand. The bundles are then speedily spread abroad, and left to dry in the sun and wind, after which they are gathered into heap-like windcocks in meadows, during the season of hay harvest; and when autumn comes, they are thrown into pits dug along the shore, and being set on fire, burn gradually, till reduced to hard dark-coloured cakes, in which state they are sent to market.

Nor less valuable are deposits of such kinds of *fuci*, when

cast by the waves upon the shore in places where as yet the plants have not begun to vegetate, or the bordering inhabitants would be unable to appropriate them;—harvest of the deep are they, anxiously expected, and attended to with equal care as those of land. In Ireland, especially, the poor almost entirely depend for manure on different kinds of *fuci*, which the waves deposit on their coasts in stormy weather. Scarcely has the storm subsided, and the towering billows abated somewhat of their fury, than troops of country-people assemble, some with cars and horses, some only with donkeys having panniers slung across their backs; others, too poor even to afford such humble assistance, eagerly collect whatever the sea has thrown within their reach, which having made into bundles, they often drag, with the aid of their wives and children, to a considerable distance. Large and succulent kinds of *fuci*, with *laminariæ*, are preferred for potato grounds; and when mixed with sea-sand they make excellent manure for different purposes.

These plants, rooting themselves in places apparently the most ungenial, exhibit an energy of vegetable life which has no parallel on land. Years have passed since an hazardous attempt was made, near the entrance of the Frith of Forth, to erect a stone beacon on a low rock called the Carr. The rock was scarcely more than twenty feet broad and sixty long, and was covered with water, except at the lowest ebb of spring tide. But, despite the waves and winds that often contended for mastery, *fuci* of different kinds grew there luxuriantly, and presented a rich oasis of verdure when rendered visible by the withdrawing of the tide; the workmen, however, did not heed them, they were soon cleared away, and a considerable portion of their rough growing-place was made smooth with pickaxes. Early in November, the work was necessarily abandoned for the winter, at which time scarcely a weed was left, the greater portion having been destroyed, and such as remained were trampled on by the workmen. The rock, thus despoiled,

was seen no more till May, when preparations being made for recommencing the stone beacon, it was found covered with large sea-weeds; specimens of the *Fucus nodosus*, the largest of British Algæ, measured six feet in length, and some even exhibited capsules filled with ripening fruit! and, true to their native habitats, sea-tangles, with their cylindrical and solid stems, and fine clear olive fronds, had also taken root on the smooth and herbless portion of the rock.

Five species of *fuci* are recognized as belonging to the British coasts, among which the *F. canaliculatus* and *F. nodosus* are best known; the one affecting rocky shores between high-water mark and half-tide level, and extending in its geographic range along the Atlantic coasts of Europe and North America, but which, unlike most of its congener, rarely covers wide spaces of rock, preferring to grow in scattered tufts or places where, at the recess of tide, the water rapidly drains off, evidently for the sake of exposure to the atmosphere during a considerable period daily; the other, similar in its ocean site to the *canaliculatus*, is seen on submarine rocks and large boulder-stones from high-water mark to high-tide level. In both, their olive hue designates that they belong to the series *melanospermæ*—a colour which increases in depth as we approach the tropics, where it reaches the maximum of species, though not of individuals.

Marine botanists, who desire to acquaint themselves with the structure of these singular productions, should obtain a branch of the *F. nodosus* or *F. canaliculatus*, and having well soaked it in water or diluted muriatic acid, cut a thin longitudinal slice, and examine it with a high magnifier, by the aid of which they will readily discover that the whole consists of four distinct parts. The central portion, corresponding to the pith of plants, occupies a third of the diameter, and is composed of parallel fibres pressed together —or rather, of numerous cells forming one complete mass. Outside appears a less dense layer, of a paler hue, which

represents the wood; this layer consists of branched fibres, either horizontal or vertical, and inextricably laced together: and surrounding these is a denser and darker layer, analogous to bark in trees, and composed entirely of closely-packed, yet simple fibres. Outside, and forming the outer coat, is a very thin layer of small cells, loosely attached, and capable of being readily separated.

The root of both species is a conical expansion, half an inch or more in diameter, by means of which they become firmly attached to marine rocks or stones washed by the tide. Some naturalists have doubted whether sea-weeds derive nourishment through the root; but this much is certain, that they are materially affected by the soil on which they grow, for different rocks yield plants of the same family in greater or less perfection.

The *Fucus Mackaii*, on the contrary, presents a singular deviation from this general habit; its large globular tufts invariably remain unattached, resting, apparently by their own weight, on mud or gravel, or among loose stones, where they flourish from year to year, and fruit abundantly.

Every plant has its own history; and that of the *Fucus serratus*, which abounds on all the Atlantic coasts of Europe, serves to elucidate a curious fact connected with Marine Botany. This plant is a world of insect life; and in order to observe its full development, collect in winter, or early in the spring, fresh specimens with orange-coloured receptacles, and leave them to dry partially. There will then exude, from the pores of each receptacle, drops of thick orange-coloured liquid, which, on being moistened with salt water and placed under a microscope, are found to consist of innumerable *antheridia*, the homes of small yellow animalculæ, which quickly begin to liberate themselves, and consequently produce those strange motions which seem irreconcilable with vegetable life.

Exotic species, such as the *Sargassum vulgare* and *Bacci-*

ferum, are thrown occasionally on the shores of Britain. Superficial observers might consider them as native species, but such is not the case; they resemble in their casual visits those stranger birds, which, driven at distant periods by uncertain winds upon our coasts, have been incautiously admitted into the British Fauna.

Thus journeying from afar, and telling of old times, these plants recall to mind the awe and wonder expressed by early navigators, when meeting with such vast accumulations as to resemble boundless floating meadows, green and pleasant to the eye, yet bringing sad thoughts of far-off scenes to those who anxiously and wearily voyaged through unknown seas.

Strange and almost fearful must those oceanic meadows have appeared, in the midst of a tumbling and raging ocean, to men who perhaps had scarcely ever ventured beyond soundings. Even now, naturalists who are familiar with the wonderful developments of vegetable life in forms peculiar to the exotic regions, regard with astonishment those oases of verdure which Humboldt has described: the one extending from the 25th to the 30th deg. of north latitude westward of Fayal; the other of the Bahamas. The locality of such banks, however, cannot be long depended on, as the plants of which they are composed float wherever they are impelled by winds or currents; vessels, therefore, often pass through vast fields in the latitude already mentioned, whilst others, steering shortly after in the same course, meet with scarcely any. Somewhat capricious, also, in the form which they assume, those ocean-fields at one time resemble vast savannahs, bounded only by the horizon—green, yet lonely, for neither bird nor insect relieves the unvaried verdure: at another, they resemble vast ridges, from ten to twenty feet broad, and seem to stretch across the sea. Such banks or fields are composed exclusively of the *F. baccata*, that wandering plant which has never yet been found except floating on the water; whereas the *F. natans vulgare* of Turner

fixes its growth on marine rocks in tropical countries. Homeless, therefore, as regards its habitat, wandering from sea to sea, and visiting the shores of this and other countries, the *baccata* is admirably adapted to a watery location. Its hollow pod-like receptacles seem designed to give buoyancy; and the smallest branch readily becomes developed into a perfect plant—hence the species are continually reproduced, and small branches, broken from the parent stem, not only increase in size, but throw off vigorous shoots in all directions.

Agardhi, the celebrated naturalist, enumerates at least sixty-three species of *sargassum*: of these, fifty-four are either tropical or sub-tropical, and never extend beyond lat. 42 deg. Specimens, therefore, of each, are found on the shores of the East Indies, China, Japan, or New Holland, Van Diemen's Land, with those of the tropical Atlantic and the Cape of Good Hope. A few exotic species exist at some distance from the Equator; two are of uncertain origin, and eight are indigenous on widely separate coasts.

CHAPTER IV.

> Come hither,
> Nor fear lest danger lurks; but firmly stand
> And look adown the waters. Beauteous plants
> Quiver and sparkle; and methinks bright hues,
> E'en such as Iris flings on watery floors,
> Are seen among them.

Beautiful or curious in their ocean sites, grow innumerable plants belonging to the series *Melanospermeæ*, among which the Fennel-like Cystoseira (*Cystoseira fœniculacea*), common to the southern shores of England, and extending to Spain and the Mediterranean, presents a

striking instance of the effect produced by dissimilar locations. When growing in deep water, beyond the reach of tides, it constitutes *Fucus discors* of marine botanists, especially if gathered during the summer months, at which season it is extremely luxuriant, with broad leaves and large air-vessels, while the same species, when developed in shallow tide-pools, and collected either late in autumn or in winter, is more branched, and has narrower leaves. Hence the name of *Fucus abrotanifolius*, or branched fucus: but on the depth of water, or difference of season, depend solely the distinguishing characters of both.

Not less worthy of remark is the Granulated Cystoseira (*C. granulata.*) This shrub-like plant produces a beautiful effect in its rocky basin—seen at one time through clear sparkling water, at another left uncovered by the tide. Those who know little concerning its specific character, may yet readily distinguish the granulated cystoseira by the knob-like basis of its branches, and though growing in a scattered manner, it is occasionally gregarious. Like others of the genus, its stems afford a welcome resting-place to various marine animals, with corallines and sponges, and parasitic sea-weeds, and are, in consequence, often covered with thick incrustations of animal life. Rare it is to find a clean-stemmed cystoseira; and however annoying this may be to the collector of specimens, the admirer of nature, when looking into a clear tide-basin, under a favourable light, rejoices in the picturesque beauty produced by a cystoseira grove, of which the brilliant colours and starry forms resemble clusters of flowers peeping from out the branches.

Portland, with its rushing waves, and that wild beach on which the tumbling billows often resemble a belt of molten silver, reveals among its sunken rocks the beautiful Heath-like Cystoseira (*Cystoseira ericoides*), which reflects the most beautiful rainbow tints as its branches wave to and fro. This iridescent plant grows also on the coasts of Devonshire and Cornwall, and is remembered in connection with many

a watery nook or beetling crag, where the harsh cry of the lonely sea-bird is often heard above the dashing of the tide, or the murmuring sound of winds sweeping among the cliffs.

With equal beauty glows the Peacock Padina, (*Padina pavonia*) on rocks in shallow pools. The general resemblance of this curious plant to the expanded tail of a peacock has been noticed by authors, and when seen growing under water, the resemblance is peculiarly striking. Few plants are more curious in their structure, or more attractive to the lovers of marine botany, for the filamentary fringes by which the outer portion of the strongly-rolled fronds are adorned separate the rays of light, and produce the most vivid rainbow tints; and with it is associated the curious fact, that although abounding in the tropical regions, and reaching its northern limits on the southern shores of England, no change whatever is discovered, either in the deepening of colour or luxuriance of vegetation. British specimens, though often exposed by the receding of the tide to every vicissitude of weather, are equally large and well coloured as those of warmer latitudes.

The elegant, though solitary, Esculenta Alaria (*Alaria esculenta*) is rarely seen on our southern shores, though abundant on such as are washed by the northern Atlantic and Pacific Oceans. The roughest waters seem most favourable to its growth, and hence its long and graceful fronds attain the greatest size, and most luxuriant development, in sites covered with rough waves and exposed to the heaviest storms. Such are its wild habitats on the shores of Scotland, and the north and west of Ireland, also Durham and Northumberland, Devonshire, and Cornwall. Those who visit the Land's-End may find this hermit plant fringing precipitous rocks at low-water mark, beautiful in its assigned locality, and cheering oftimes the heart with thoughts of love and trust, amid the sternest solitudes of man.

Young algologists who wish to obtain specimens of the Footed Sporochnus (*Sporochnus pedunculatus*) must seek for them by means of dredging. When thrown upon the coast, or entangled in the nets of fishermen, they are rarely perfect; and yet none are more worthy of regard, being equally rare and beautiful. Happy the collector who, when the tide is out, may espy the branches of this clear olive-tinted plant waving in some deep rock basin! but how much is the pleasure of its discovery heightened, and what trains of soothing or solemn thoughts arise within the mind, when gathered from some memorial place; perchance within sight of Preston-Pans, or beside the Frith of Forth, where the storming incidents of the one, or the wild magnificence of the other, become associated with this most delicate of oceanic Algæ.

Observe the Leafy Laminaria (*Laminariæ phyllitis*) vegetating on rocks and stones, or in small coves left by the receding of the tide; as also its unassuming relative, the *L. fascia*, or bundle-leaved, which rather affects sand-covered rocks. These plants afford, in their comparative minuteness, contrasts to those of the same family which attain their full development in the exotic regions of the globe; and scarcely may the botanist, when looking into the clear calm waters that often cover their submarine habitats, recognize in gigantic specimens of the Finger-like Laminaria (*Laminariæ digitata*) plants indigenous to Britain. Yet, palm-like in their mode of growth, and rising from out their rocky beds to a considerable elevation, they oftimes extend far as the eye can reach, and present an aggregate of verdure which equals in richness and luxuriance the magnificence of tropical vegetation. The *Lessonia fusca* attains the height of twenty-five or thirty feet, with a tall and straight trunk, of considerable thickness, throwing out numerous branches, and covered with lancet-shaped leaves. The *L. buccinolia*, or trumpet-weed of the Cape of Good Hope, presents, on the contrary, a hollow stem, which the

natives form into a kind of musical horn; and hence travellers often hear the deep and sonorous sounds produced by these marine trumpets, when lingering on shores, beside which are seen the dripping and tufted heads of the *L. buccinolia* left uncovered by the tide, and glistening in the beams of morning. Adventurous boys assist one another in warily descending the slippery side of sea-cliffs till they come within reach of a straggling branch, which they bear off in triumph; and soon another burst of wild melody responds from behind some jutting cliff, blending with the roar of ocean, and awakening images of far-off days when the credulous ear of childhood listened at every pause of rushing waters for the songs of sea-nymphs, warbling from out the deep.

But the larger of all known Algæ, though comparatively slender, are different members of the brotherhood of *Macrosytes*, of which the most common is the *M. parafera*. This graceful plant, emulating in slightness and in loftiness the arborescent bamboos and ferns described by Humboldt, occasionally rises to the height of fifteen hundred feet. The leaves are long and narrow, and at the base of each is a strong vessel filled with air, by aid of which the *macrosytes* is enabled to support its great length in a fluctuating element, for the stem at its greatest size is about the thickness of a finger, and the upper branches are as slender as packthread. The plants, therefore, require a peculiar organization; and their roots, similar to those of forest trees, are strong and fibrous, and well adapted to take firm hold of the huge masses of broken rocks among which they grow. Proofs are they, both in growth and structure, that oceanic vegetation bears an obvious reference to its unstable and aqueous element—equally with that of land, to the elements by which it is surrounded. The depths of ocean are, consequently, varied with submarine forests, beautiful in their diversity, as the primæval woods of recently-discovered lands, often of vast extent, and intermingled with breaks of lawn; and

thickets which, growing low, and unvisited by storms, are slightly fixed to their growing-places by means of simple shield-like disks. The breaks of lawn, if such they may be termed, are covered with beautiful sea-weeds, of various forms and hues; and the trunks of the loftier tree-like species present extraneous tufts of vegetation, analogous to lichens and mosses. Parasitic sea-weeds, glossy and soft as silk, or formed of transparent membranes, also become attached to the stems and branches; some minute and exquisitely tinted, others of larger growth, but each the home or storehouse of joyous creatures, that glide in and out, and find both food and shelter in the places to which they are assigned. And as beneath the waters, so also, not unfrequently, upon their surface, is the same diffusion of animated existence.

Navigators in old times, when steering through those ocean meadows, concerning which Columbus spoke in his voyage of discovery, saw in them only vast extents of verdure; but men belonging to the days in which we live, when the light of science continually discovers new subjects for instruction, find that they are tenanted by numerous living creatures. Nor is this peculiar to those archipelagos of floating islands. A recent voyager relates, that he observed a large pine, similarly peopled, which drifted some way beside his vessel. Barnacles adhered in great numbers to the trunk; and among the branches and trailing fuci were shrimps and teredos, with large water insects, and a kind of small fish. The latter especially seemed full of life, for they swam merrily about, darting at one time among the branches, at another emerging to the full light of day; crabs sunned themselves on the parasitic fuci, and creatures of strange forms sprang from out the waters, to sieze the pendent tufts of sea-weed. "Methought," said the narrator, "while looking at them, no portion of the globe is more thickly inhabited, or affords, in proportion to its size, a greater amount of animal enjoyment, than this wave-tossed isle."

Among such of the aquatic flora as form extensive submarine meadows, the String-like Corda, or *Corda felicem*, is most frequent on our shores. Its long and narrow tufted fronds, clothed with innumerable gelatinous filaments, are not unfrequently at least forty feet in length, and, though common to rocks and stones washed by the tide, attain the greatest perfection in quiet, land-locked bays, with a sandy, or somewhat muddy bottom. In such places the corda forms extensive meadows, so dense as often to endanger the unfortunate swimmer, who rashly ventures among its slimy and tenacious cords, however pleasing to the eye, while gently undulating with every motion of the stream. Venture not, therefore, in watery places where grows the string-like corda, for the risk is great, even if its floating cords are seen at a considerable depth beneath the surface, but rather obtain a rambling branch from off the shore, and examine its wonderful construction. Each frond is composed of a single fillet, one or two lines in breadth, spirally wreathed into a filiform tube, formed by the cohesion of its edges, and these, when separated from the outer skin and firmly twisted, acquire such a degree of strength and roughness, that Highlanders use them for fishing-lines. Hence in Scotland, the name of Lucky Minny's lines—in England, sea-traces, as if fitted to curb the steeds of Neptune. Strange contrasts are they to the withered-looking Deusta (*Kalfsia deusta*), which rather resembles a crustaceous lichen than an Algæ, and which, common to the rocky shores of the Northern Atlantic Ocean, from Iceland to France, spreads over their surfaces in dark-brown crustaceous patches. While young, these patches are orbicular and smooth, but become irregular in outline when old, and are covered more or less with wart-like prominences, occasionally even presenting an exceedingly rugged surface, similar to the bark of aged trees.

Such are a few among the numerous families that compose the series *Melanospermeæ*, conspicuous either for utility or beauty, large expansion or minuteness. Ranging through-

out all seas, or growing on the shores of different countries, some species even serve as food, and are eagerly collected by the bordering inhabitants. In Asia, different kinds of Laminaria render palatable the hot condiments of the East; and such as are common to Australia yield nutritious food, and vessels for domestic purposes. Knife-handles are made in Scotland from the stems of the finger-like Laminaria (*Laminariæ digitatæ*); and when tipped with metal, they can hardly be distinguished from those of horn. In medicine, the most important benefits result from iodine, which is extracted from the *Laminaria buccinalis*. The *Gigantina tinens* forms, in China, an important article of commerce, and at least twenty-seven thousand pounds weight are annually imported into Canton from two provinces. A tenacious glue is extracted by long boiling, which the ingenious Chinese use in manufacturing their lanterns, and with the same they also render them transparent. Travellers conjecture that it forms a principal ingredient in the gummy substance with which the lozenge-shaped interstices of their windows, simply formed of bamboo strips crossed diagonally, are wholly filled up.

MELANOSPERMEÆ.

Name derived from two Greek words, signifying *black* and *seed*.

Marine plants of an olive-brown colour, changing to black in the air, of a leathery or woody substance, and fibrous texture.

Root, in some species accompanied with creeping fibres. Froud flat, compressed, or filiform, in many producing distinct leaves, and in most, furnished with air-vessels. Fructification, spherical clusters of opaque seeds. embedded in distinct gelatinous receptacles, and finally escaping through external pores.

Sea-weeds belonging to this series are most frequent about half-tide level, and are generally of a large size; when

rowing in deep water, they either become brown or nearly lack.

Family I.—Fucæ.

Plants turning to black when dry; their substance leathery or woody. Fronds flattened or hair-like, or forming distinct leaves, many of the species bearing air-vessels. Seeds contained in distinct gelatinous receptacles.

FUCUS NODOSUS.*

The term *Frond* generally comprises every part of a

* The whole of the beautiful illustrations which appear in this volume have been copied, by permission of Dr. Harvey and Messrs. Reeve, Benham, and Reeve, from *Phycologia Britannica, or British*

marine plant except the root; occasionally the stem, if well developed and distinct, is not included.—*Harvey*.

I. *Sargassum*. A word formed from the Spanish *sargazo*, a name given by navigators to the floating sea-weed.

1. *Vulgare*, common sargassum.
2. *Bacciferum*, berry-bearing.

II. *Cystoseira*. From a Greek word signifying bladder and chain, because the air-vessels are generally arranged in strings.

1. *Ericoides*, heath-like cystoseira.
2. *Granulata*, granulated.
3. *Barbata*, bearded.
4. *Fœniculacea*, fennel-like.
5. *Fibrosa*, fibrous.

III. *Halidrys*. The sea, an oak.

1. Siliquosa, pod-bearing halidrys.

IV. *Pycnophycus*. Signifying thick, and sea-weed.

1. *Tuberculatus*, swelling pycnophycus.

V. *Fucus*. Signifying sea-weed.

1. *Vesiculosus*, bladder fucus, the keutang of Norway, cow-weed of the north-west of Scotland and Ireland, and swine-tang of Gothland.
2. *Ceranoides*, lesser.
3. *Serratus*, toothed or serrated fucus, the bread-tang of Norway.
4. *Nodosus*, knotted.

Sea-Weeds, the most elaborate work extant upon this subject. I contains a faithful coloured figure of every plant inhabiting the British shores.

5. *Mackaii*, named after its discoverer, James T. Mackay—The Mackay.
6. *Canaliculatus*, grooved or channeled.

VI. *Himanthalia*. From three Greek words, a strap, a branch, the sea.

1. *Lorea*, sea-throng lorea.

Family II.—Laminariæ.

Olive-green or brown; membranaceous or leathery. Frond leaf-like, stalked, cleft, and sometimes with a mid-

LAMINARIA FASCIA.

rib. Seeds in spots or sori, on the surface of the frond.—*Harvey*.

VII. *Alaria.* From *ala*, a wing, in allusion to the winged frond.

1. *Esculenta*, esculent alaria, called baderlocks, or kenware, in Scotland; in the Orkney Islands, honey-ware; in Ireland, marlin.

VIII. *Laminaria.* From *lamina*, a thin plate, in allusion to the flat frond.

1. *Digitata*, finger-like laminaria, or "sea-girdles and hangers."
2. *Bulbosa*, bulbous-rooted, or great fur-belowed laminaria.
3. *Saccharina*, sweet laminaria, or sea-belt.
4. *Phillitis*, leafy hart's tongue.
5. *Fascia*, bundle-leaved.

Family III.—Sporochnoideæ.

Plants chiefly of a yellowish-green, branches leafy or hair-like; speedily decomposing on exposure to the air.

Fronds occasionally bearing deciduous tufts of bright green filaments.

Fructifications, mostly warts, or little stalked, club-shaped bodies.—*Harvey.*

IX. *Desmarestia.* Named in honour of A. G. Desmarest, a celebrated French naturalist.

1. *Ligulata*, strap-leaved desmarestia.
2. *Virides*, green or flourishing.
3. *Aculeata*, spiny.

X. *Sporochnus.*

1. *Pedunculatus*, footed sporochnus.

XI. *Corpomitra.* Signifying fruit, a cap or mitre.

1. *Cabreræ*, tendril carpomitra.

XII. *Arthrocladia*, from joint and a branch.
1. *Villosa*, fibrous arthrocladia,

DESMARESTIA LIGULATA.

FAMILY IV.—DICTYOTEÆ.

Marine plants, of an olive-green colour, and membranaceous, flexible substance, rarely cartilaginous or juicy, with a highly reticulated or veined-like net-work structure.

Frond round or flat, simple or branched, without nerves or veins, excepting in Halyseris; often divided in a fan-like manner.

Fructification either in lines, in patches, or sori, and

covering the whole of the frond; very rarely enclosed in capsules.—*Harvey.*

XIII. *Cutleria.* In honour of Miss Cutler, of Sidmouth, a distinguished algologist.

1. *Multifida,* abundant cutleria.

XIV. *Halyseris.* From the sea, and endive.

1. *Polypodioidęs,* polypodious halyseris.

PADINA PAVONIA.

XV. *Padina.* A name invented by Adanson, who has not explained the meaning.

1. *Pavonia,* peacock-like padina.

XVI. *Padinella.* Most probably from Padrus, the river Po, whence comes the diminutive *Padinella;* perhaps because this weed is found in the Adriatic, near the mouth of that river.

1. *Parvula,* weak or small padinella.

XVII. *Dictyota.* Name signifying a net, from the reticulated structure of the frond.

1. *Dichotoma*, cleft dichotoma.
2. *Atomaria*, atom-like.

XVIII. *Stitophora.* Name derived from the Greek, signifying a point or dot; and to bear, in allusion to the dot-like fructification.

1. *Rhizodes*, iris-like rhizodes.
2. *Lyngbyæi*, probably a foreign surname.

XIX. *Dictyosiphon.* From two Greek words, signifying a net or tube.

1. *Fæniculaceus*, grass-like dictyosiphon.

XX. *Striaria.* From the seed vessels being arranged in transverse lines.

1. *Attenuata*, slender striaria.

XXI. *Punctaria.* From punctum, a dot, the fruit being in dots.

1. *Latifolia*, broad-leaved punctaria.
2. *Plantaginea*, plantain-leaved.
3. *Tenuissima*, slender.

XXII. *Asperococcus.* From asper, rough; and a Greek word signifying seed, the dots of seeds being mixed with bristle-like filaments.

1. *Compressus*, compressed asperococcus.
2. *Turneri*, in honour of Turner.
3. *Echinatus*, rough.

XXIII. *Chlorosiphon.* Signifying pale green, and tube-like.

1. *Pusillus*, small chlorosiphon.
2. *Laminariæ*, thin-plated.

XXIV. *Chorda.* A cord.

1. *Filium*, string-like chorda, or sea laces
2. *Lomentaria*, contracted.

Family V.—Ectocarpeæ.

Marine plants of an olive-green, very rarely of a full green colour; filamentous: often capillary or cobwebby, jointed, cartilaginous, or flaccid; not very juicy.—*Harvey.*

XXV. *Cladostephus.* A branch and crown.

1. *Verticillatus*, whorled cladostephus.
2. *Spongiosus*, spongy.

SPHACELARIA PLUMOSA.

XXVI. *Sphacelaria.* Gangrene, alluding to the withered tips of the branches.

1. *Felicina*, fern-like sphacelaria.
2. *Serlutaria*, clover-like.
3. *Scoparia*, clustered.
4. *Plumosa*, feather-like.
5. *Cirrhosa*, the tendril-bearing.
6. *Fuca*, coloured.
7. *Radicans*, rooted.
8. *Olivacea*, olive.
9. *Racemosa*, clustered.

XXVII. *Ectocarpus.* Name signifying external, and fruit.

1. *Littoralis*, shore-loving ectocarpus.
2. *Reticulosus*, netted.
3. *Fasciculatus*, small-branched.
4. *Hinksiæ*, in honour of Miss Hincks.
5. *Scorpioides*, scorpion-shaped.
6. *Spinescens*, thorny.
7. *Longifructus*, long-fruited
8. *Amphibius*, ample.
9. *Tomentosus*, spongy.
10. *Crinitus*, hairy.
11. *Pusillus*, small.
12. *Simplex*, simple.
13. *Villum*, hairy.
14. *Distortus*, irregular.
15. *Granulosus*, grained.
16. *Sphærophorus*, ball-carrying.
17. *Brachiatus*, branched.
18. *Mertensii*, probably a foreign naturalist.

XXVIII. *Myriotrichia.* Signifying a thousand, and a hair.

1. *Clavæformis*, club-formed myriotrichia.
3. *Filiformis*, fern-like.

Family VI.—Chordariæ.

From a Greek word, signifying a cord or string.

XXIX. *Myrionema.* Signifying a thousand, and a thread.

1. *Strangularis*, crooked myriaonem.
2. *Leclancherii.*
3. *Punctiforme*, pricked.
4. *Clavatum*, club-shaped.

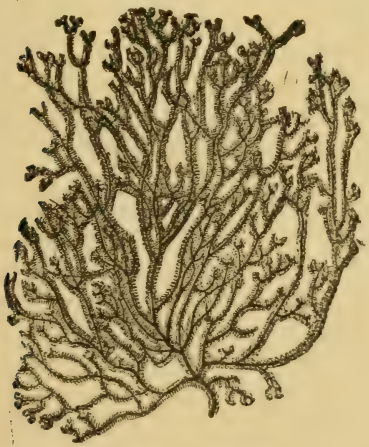
XXX. *Elachistea.* The meaning dubious; but seemingly from a Greek word, least.

1. *Fucicola*, purple-yielding elachistea.

2. *Flaccida*, flagging.
3. *Curta*, short.
4. *Pulvinata*, powdered.
5. *Stellulata*, full of stars.
6. *Suctulata*, shield-like.
7. *Velutina*, hairy.

XXXI. *Ralfsia.* In honour of John Ralfs, Esq., an accurate botanist, to whom the science is much indebted.

1. *Deusta*, withered-looking deusta.



CHORDARIA DIVARICATA

XXXII. *Leathesia.* In honour of the Rev. Mr. Leathes, a British naturalist.

1. *Tuberiformis*, knob-shaped leathesia.
2. *Berkleye*, the Berkeley.

XXXIII. *Mesogloia.* Middle, and viscid, in allusion to its gelatinous axis.

1. *Vermicularis*, chequered mesogloia.

2. *Virescens*, green.
3. *Griffithsiana*, in honour of Mrs. Griffith. The Griffith.

XXXIV. *Chordaria*. A cord, because the branches resemble small cords.
1. *Flagelliformis*, small-branched chordaria.
2. *Divaricata*, divided.

CHAPTER V.

Series II.—Rhodospermeæ.

Pass not unheeding, while the punctual tide
In calm, deep, silent might comes sweeping on,
Till, rushing with loud sounds, and tossing crests,
It leaps and rages, thundering on the shore,
And whirling in its fury wide and far.
Mark well yon sea-weed, rooted on the rock!
The madden'd surge assails its fragile form,
And yet it moves not, clinging with small hands,
An emblem flower, methinks, of steadfast ones,
Who dwell in peace amid earth's wild turmoils.

Ilfracombe, with its rocks and coves, and wild sea-dance of waves from the Atlantic, is rich in marine productions. The parasitic and sponge-like Callithamnion (*Callithamnion spongiosum*) is seen adhering to different kinds of Algæ, in rosy or brown-red conically shaped tufts, which retain water like a sponge. This isolated species, common to the British islands and Atlantic shores of France, never grows beside its brother, the shrubby Callithamnion (*C. arbuscula*), though both affect similar localities on different shores, covering many a rugged or perpendicular sea-cliff with their globose tufts, over which the spray of ocean vanishes and reappears, and streams adown the sloping sides like molten silver.

Widely different is the habitat of the deep lake, or rosy-red Callithamnion (*C. roseum*), which displays its pure and brilliant fan-shaped pinnæ, in contrast to mud-covered rocks; and equally incongruous that of the rare and intricately tufted *C. barbatum*, which derives some degree of adventitious beauty from the site whereon it grows. Children are they of neither rock nor sand, but of mud-banks, whereon all others refuse to vegetate, as if even those unsightly places, where the sea deposits its froth and scum, should not be wanting in the loveliest of her productions. They read, methinks, a lesson to the heart, hinting that moral beauty, nay, even Christian perfection, may exist in haunts the most ungenial—the more lovely because of hindrances; the more prized in the sight of those who look on, though to us invisible, because there has been nought of outward means by which to uphold or cherish the moral flower.

"There are in the loud stunning tide
Of human care and crime,
With whom the melodies abide,
Of the everlasting chime:

"Who carry music in their heart,
'Mid jostling street and dusty mart:
Plying their daily task with willing feet,
Because their inmost souls a holier chime repeat."

Far different sites are assigned to the *C. Turneri* and *C. tetricum*, the Turner, and rough Callithamnion: the former, a memorial plant, which recalls to mind its first discoverer, Dawson Turner, is generally parasitic on various kinds of Algæ, creeping, by means of small roots, over the surface of marine plants, and covering them with rose-red filaments; the second often grows luxuriantly in pools of salt water left by the receding of the tide, or flings occasionally its brown-red branches over different kinds of Algæ. In both, the naturalist discovers that the glory of all natural things con-

sists in unity, in a mutual dependence of one upon the other, or the elements by which they are surrounded. What signifies it, a looker-on might say to the latter of these plants, whether growing in one place or the other, provided that a rock supports its disc-shaped root, and that the rock is within tide-mark? Much, every way. In some localities, little exuberance is displayed; in others, the same plant throws out abundant and regular filaments, and becomes fully developed; such is the case, especially, when growing on the perpendicular sides of marine rocks, left uncovered at low-water, and either open to the sun, or else shaded by pendant fronds of the *Fucus serratus* and *F. nodosus*.

Few, perhaps, among parasitic sea-weeds, are more delicate in their construction, or softer in hue, than the many scaled Callithamnion (*C. polyspermum*). A poet, perhaps, would tell you, that this friendly plant loves to embellish the more unsightly species, such as are rough of leaf, and with little of outward beauty to commend them. On these it grows profusely, and covers them ofttimes with densely set, and globose tufts of brownish, or somewhat purplish red, till all that is ungainly-looking in the plant becomes concealed, and passers-by linger with delight beside its growing-places. Nor less gentle in its nature the many-sided Callithamnion, which readily adheres when spread on paper, and exhales, if moistened, a scent of violet.

Naturalists in all ages have associated names of worth or talent with their favourite plants; and hence those of *Brodiæi* and *Borreri* in the family of *Callithamnion;* the former a brownish-red and tufted plant, peculiar to this country, and restricted to the coast of Northumberland, Torquay, Cornwall, and Torres; the latter ranging along the Atlantic shores of France and Spain, of the Mediterranean and Adriatic seas, equally with those of Britain. This plant is eminently beautiful, and may be readily distinguished among its brethren by the lower half of its plumules being

bare of ramuli, while the upper is pinnated and spreads like the rays of a fan.

And yet, though bearing no greater name than its own simple and appropriate designation, the small-footed Callithamnion (*C. pedicellatum*) speaks to the passer-by concerning that singular distribution of oceanic plants, which seems irrespective either of rock or flood. Nestling ofttimes in deep rock basins of clear water, or else dredged in from four to seven fathoms, and widely distributed around our western coasts, it is vainly sought for in places equally congenial to its growth and habits on the eastern coasts. Scotland regards it as one of her rarest plants, and scarcely may the botanist discover it in the north of England.

Scattered throughout the seas of all temperate climates, and reaching even to the troubled waters of Cape Horn, the genius Griffithsia, including thirty species, commemorates the indefatigable researches and accurate knowledge of the algologist of Devonshire. Among these, one species alone is tropical, several of great beauty are found on the shores of the Mediterranean and Australia; and the Cape of Good Hope and Western Africa contribute many others; but wherever located, they uniformly possess one common property, that of being exceedingly impatient when coming in contact with fresh water. In order, therefore, to secure well-preserved specimens, they should be brought home in their native element, and laid immediately on paper. A brief exposure to the air occasions their decomposition, and even salt water, after a few hours' immersion, causes the cellular membrane to divide, and the coloured matter to be discharged with violence.

Among this numerous tribe, the *Griffithsia Devoniensis*, which differs from every other species, was discovered about fifteen years since at Plymouth, and added to the flora of Devonshire by Mrs. Wyatt. Harvey records its favourite habitat in the specific name, well pleased that while the generic appellation recalls to mind the obligations of algology,

the specific should bear the name of a country rich in marine productions, as also the favourite residence of their most distinguished votary.

The microscope is a revealer of things hitherto invisible. Examine by its aid a bunch of the hairy Gloiosiphonia (*Gloiosiphonia capillaris*), and what exquisite transparency is everywhere perceptible. The pyramidal and thickly-branched tufts, of a fine clear rosy crimson hue, look well in their native tide-pool; and the artist who essays to paint them, may delineate an object of exceeding beauty; but the microscope discovers that the whole plant, being equally fragile and delicate of texture, and exposed to the ebbing and flowing of the tide, is protected by an extraneous coating. Thus among land-plants, when the stems are hollow, and the places of their growth liable to be swept over by fierce winds, the material of which they are composed is so condensed on the surface as to possess nearly the hardness of metal. This peculiarity is very obvious in the bamboo tribe. Silex is one of their component parts; and if two pieces of bamboo are rubbed together, they emit a pale light. Corn stalks, with those of grasses, are similarly protected; they contain potash sufficient to form glass with their flint; and if a wheat or barley straw, or even a stalk of hay, be subjected to the action of a blow-pipe, a perfect globule of hard glass may be obtained. And, as in land-plants that are exposed to storms of wind and rain, a peculiarity of structure or external coating is required, so also in such of marine growth as are liable to be affected by sudden inundations. Of this, the hairy Gloiosiphonia offers a familiar instance. Its growing place, as already mentioned, is a tide-pool, into which the waters often rush with tremendous violence, foaming and recoiling, and whirling round and round; while the meek and tender plant, thus wondrously protected by an extraneous coating, keeps its place uninjured.

Growing occasionally on the same rock as the hairy

Gloiosiphonia, is seen the rare and beautiful *Naccaria wigghii*, and the dull-red furry Chuoria (*Chuoria hellita*); the one delighting the passer-by with its brilliant rose-tinted fronds; the other, a species of marine lichen, which adheres so closely to its watery habitat, that it can only be removed by scraping the rock with a knife. This strange plant was first noticed on the shores of Norway, and those of the Feroe islands, and has since been found spreading over the surface of bare rocks, and forming smooth glossy patches of from two to three or more inches in diameter. Its ensanguined hue, which resembles a blood-stain upon the rock, accords with many of its sterile habitats amid the strife of elements; in places, too, once haunted by those fierce sea-kings who spread desolation over the finest portions of Europe.

There is not, methinks, a fragment of rock, however stern and lonely, or sea-girt, nor yet a sea-weed, humble though it be, and dull of hue, which has not adorable manifestations of wisdom inscribed thereon. Humboldt spoke concerning the Southern Cross, and the emotion which it awakened in his mind, when crossing the vast plains of the New World. "Midnight is past," exclaimed the guide, "for the Southern Cross begins to bend;" and truly it seemed as if some invisible hand had gently touched a secret spring, and caused the bending of the Cross, that men who journeyed through the night might be cheered with the hope of day-break. But who, when passing some wild rock, covered with brown-red or blackish-purple tufts of the *Griffithsiæ gymnoyongrus*, would expect to see the symbol of our faith inscribed among them as clearly as the Southern Cross when becoming visible. The fructification of this plant is a beautiful microscopic object—strings of small pear-like substances, arranged with the most perfect symmetry, are each marked with a white cross, and enclosed in ruby-tinted sheaves. Thus much the microscope reveals, bringing hidden things to light, and investing with a sacredness of

character that wild sea-weed which is dispersed on most of the Atlantic shores, from a high northern latitude to the tropics, though as yet undiscovered in the Southern ocean.

CHAPTER VI.

RHODOSPERMEÆ.

Marine plants of a rose-red, purple, or red-brown colour, leafy, cylindrical, or filamentous. Fructification mostly double, the primary contained in capsules, receptacles, or immersed in the frond; the secondary (when present) minute granules, forming sori, scattered or defined patches, or embedded in distinct receptacles. Seeds, red or red-brown.—*Harvey.*

FAMILY VII.—CERAMIEÆ.

PTILOTA PLUMOSA. Communicated by a friend, from the coast of Ayrshire. July 1849.

XXXV. *Callithamnion.* Name derived from two Greek words, signifying beautiful, and a little shrub.

1. *Plumula*, small feathery callithamnion.
2. *Cruciatum*, cross-like.
3. *Floccosum*, woolly.
4. *Turneri*, Turner's.
5. *Pluma*, feathered.
6. *Barbatum*, bearded.
7. *Arbuscula*, shrubby.
8. *Brodiæi*, the Brodie.
9. *Tetragonum*, square-branched.
10. *Harveyanum*, the Harvey.
11. *Tetricum*, rough.
12. *Hookeri*, the Hooker.
13. *Roseum*, rosy.
14. *Byssoideum*, fine-formed.
15. *Polyspermum*, many-seeded.
16. *Fasciculatum*, small-bundled.
17. *Borreri*, the Borreri.
18. *Tripinnatum*, thrice-winged.
19. *Affine*, compressed.
20. *Gracillimum*, slender.
21. *Thuyoideum*, clustered.
22. *Corymbosum*, corymbose.
23. *Spongiosum*, spongy.
24. *Pedicellatum*, small-footed.
25. *Floridulum*, florid.
26. *Rothii*, the Rothi.
27. *Mesocarpum*, middle-fruit
28. *Sparsum*, spreading.
29. *Daviesii*, the Davy.

XXXVI. *Seirospora.* A name derived from two Greek words—a chain, and a seed.

1. *Griffithsiana*, in honour of Mrs. Griffith. The Griffith seirospora.

XXXVII. *Wrangelia.* In honour of Baron von Wrangel, a Swedish naturalist.

1. *Multifida*, many-cleft Wrangelia.

XXXVIII. *Griffithsia.* In honour of Mrs. Griffith, of Torquay, the most distinguished of British algologists; so named by Agardhi.

1. *Equisetifolia*, equisetum-like Griffithsia.
2. *Simplicifilum*, simple-leaved.
3. *Barbata*, bristly.
4. *Devoniensis*, the Devonshire.
5. *Corallina*, coralline-like.
6. *Secundiflora*, the one-side-flowering.
7. *Setacea*, bristled.

XXXIX. *Spyridia.* Signifying a basket.

1. *Filamentosa*, filamentous spyridia.

XL. *Ceramium.* Signifying a pitcher.

1. *Ciliatum*, ciliated ceramium.
2. *Acanthonotum*, thorn-backed.
3. *Echionotum*, prickly.
4. *Flabelligerum*, windy.
5. *Nodosum*, knotty.
6. *Pellucidum*, transparent.
7. *Strictum*, concise.
8. *Gracillimum*, slender.
9. *Diaphanum*, red-dotted.
10. *Fastigiatum*, pyramid-shaped.
11. *Deslongchampsii*, the Deslongchamp.
12. *Decurrens*, spreading.
13. *Botryocarpum*, grape-like.
14. *Rubrum*, red.

XLI. *Microcladia.* From small, and a branch.

1. *Glandulosa*, grained microcladia.

XLII. *Ptilota.* Signifying pinnated or winged.
1. *Plumosa*, feathery ptilota.
2. *Sericea*, silk-like.

Family VIII.—Gloiocladia.

Fig. 1. Fig. 2.

Crouania Attenuata (Fig. 1), growing on *Cladostephus spongiosus*. Fig. 2, a branch magnified.—*Harvey's Phycologia Britannica.*

XLIII. *Crouania.* In honour of two brothers of the name of Crouan, of Brest.
1. *Attenuata*, slender Crouania.

XLIV. *Dudresnaia.* In honour of M. Dudresnay.
1. *Coccinea*, crimson-coloured Dudresnay.
2. *Divaricata*, spreading.

XLV. *Nemalion.* Thread, and a cross.
1. *Mutifidum*, many-cleft nemalion.

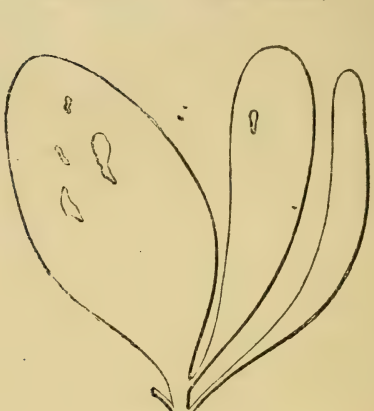
XLVI. *Gloiosiphonia.* Viscid, and a tube.
1. *Capillaris*, hairy gloiosiphonia.
2. *Purpurea*, purple.

XLVII. *Naccaria.* In honour of Naccari, an Italian botanist.
1. *Wigghii* (proper name), the Wigg Naccari.

XLVIII. *Cruoria.* From a Greek word signifying blood, because the plant resembles a blood-stain on the rock.

1 *Pellita*, furry cruoria.

Family IX.—Nemastomeæ.



Iridæa Edulis. Contributed by Dr. Cocks, of Falmouth, Cornwall.

XLIX. *Iridæa.* Rainbow, because some species reflect rainbow colours when growing under water.

1. *Edulis*, edible iridæa.

L. *Catanella.* A little chain, in allusion to the necklace-form of the frond.

1. *Opuntia*, herb-like catanella.

Family X.—Spongiocarpeæ.

Phyllophora Rubens.—*Harv. Phy. Brit.*

LI. *Polyides.* Many forms; a name ill applied to the present genus.

1. *Rotundus*, globular polyides.

LII. *Furcellaria.* From *furcella*, a little fork, alluding to the forked frond.

1. *Fastigiata*, pyramid-shaped furcellaria.

LIII. *Gymnogongrus.* Signifying uncovered warts, in allusion to the appearance of the fruit.

1. *Plicatus*, folded.
2. *Griffithsiæ*, the Griffith gymnogongrus.

LIV. *Chondrus.* Signifying a cartilage.

1. *Crispus*, curled chondrus.
2. *Norvegicus*, Norwegian.

LV. *Phyllophora.* Membranaceous, with small fronds.
1. *Rubens*, red phyllophora.
2. *Brodiæi*, the Brodie.

LVI. *Peyssonelia.* In honour of J. A. Peyssonel, an early observer of marine plants, especially corallines.
1. *Dubyi*, the Dubyi Peyssonelia.

LVII. *Hildenbrantia.* More known by the name of *Ralfsia deusta*, in honour of John Ralfs, of Penzance.
1. *Rubra*, red hildebrantia.

Family XI.—Gastrocarpeæ.

LVIII. *Kalymenia.* Signifying a beautiful membrane.
1. *Reniformis*, simply-branched kalymenia.
2. *Dubyi*, the Duby.

LIX. *Halymenia.* The sea, and a membrane.
1. *Ligulata*, strap-leaved halymenia.

Dumontia Filiformis.—Dr. Cocks, Falmouth, Swanpool, on rock, Feb. 1845.

LX. *Ginnannia.* In honour of Count Ginnanni, of Ravenni, author of a work on the productions of the Adriatic.

1. *Furcellata*, forked Ginnannia.

LXI. *Dumontia.* In honour of M. Dumont, a rench naturalist.

1. *Filiformis*, thread-like Dumontia.

Family XII.—Coccocarpeæ.

Gigartina Mamillosa.—*Harv. Ihy. Brit*

LXII. *Gigartina.* A grape stone, which the tubercles resemble.

1. *Pistillata*, pestle-like gigartina.
2. *Acicaluris*, needle.
3. *Teedii*, the Teedy.
4. *Mamillosa*, abundant.

LXIII. *Gelidium.* From *gelée*, frost, whence also gelatine; but none of the species are gelatinous.

1. *Corneum*, horny gelidium.
2. *Cartilagineum*, cartilaginous.

LXIV. *Grateloupia.* In honour of Dr. Grateloup, a French algologist.

1. *Felicina*, fern-like Grateloup.

Family XIII.—Sphærococcoideæ.

Rhodymenia Palmata.—Contributed by Dr. Cocks.

LXV. *Hypnea.* An alteration of Hypnum, the name of a genus of mosses, in allusion to the mossy character of some of the original species.

1. *Hypnea purpurescens*, purple hypnea.

LXVI. *Gracilaria.* From *gracilis*, slender.

1. *Erecta*, erect gracilaria.
2. *Confervoides*, thick.
3. *Compressa*, compressed.
4. *Multipartita*, many-parted.

LXVII. *Sphærococcus.* From two Greek words, a sphere or globe, and fruit.

1. *Sphærococcus coronopifolius*, crown-leaved sphærococcus.

LXVIII. *Rhodymenia.* From two Greek words, red, and a membrane.

1. *Bifida*, cloven rhodymenia.
2. *Laciniata*, jagged.
3. *Palmetta*, branched.
4. *Membranifolia*, membrane-leaved.
5. *Cristata*, tufted.
6. *Ciliata*, hairy.
7. *Jubata*, maned.
8. *Palmata*, hand-shaped.

Family XIV.—Delesserieæ.

LXIX. *Plocamium.* From the Greek, braided-hair.

1. *Coccineum*, scarlet plocamium.

LXX. *Delesseria.* In honour of Baron Delessert.

1. *Sanguinea*, red dock-leaved Delesseria.
2. *Sinuosa*, plaited.
3. *Alata*, winged.
4. *Angustissima*, narrow.
5. *Hypoglossum*, tongue-shaped.
6. *Ruscifolia*, box-leaved.

LXXI. *Nitophyllum.* Corruptly formed from *nitor*, to shine, and a leaf—shining-leaf.

1. *Punctatum*, pricked, spotted.
2. *Hilliæ*, the Hilli.
3. *Bonnemaisoni*, the Bonnemaison.
4. *Gmelini*, Gmelin's.
5. *Laceratum*, torn.
6. *Versicolor*, the changing-colour.

Delesseria Sanguinea.—Contributed by Dr. Cocks.

Family XV.—Chondrieæ.

LXXII. *Bonnemaisonia.* In honour of M. Bonnemaison, a French naturalist.

1. *Asparagoides*, asparagus-like Bonnemaisonia.

LXXIII. *Laurencia.* In honour of M. de la Laurencie, a French naturalist.

1. *Pinnatifida*, pinnatified Laurencia.
2. *Hybrida*, mongrel.
3. *Obtusa*, blunted.
4. *Dasyaphylla*, hairy
5. *Tenuissima*, slende

LXXIV. *Chrysimenia.* From two Greek words, golden, and a membrane; because the species acquires golden tints if long steeped in fresh water.

1. *Clavellosa*, round-knobbed clavellosa.

CHYLOCLADIA PARVULA.—Contributed by Dr. Cocks.

LXXV. *Chylocladia.* From two Greek words, juice, and a branch.

1. *Ovalis*, egg-shaped chylocladia.
2. *Kaliformis*, jointed saltwort.
3. *Reflexa*, turned back.
4. *Parvula*, lesser.
5. *Articulata*, jointed, coralline-like.

FAMILY XVI.—CORALLINEÆ.

LXXVI. *Corallina.* Name derived from resembling coral.

1. *Officinalis*, medicinal.
2. *Elongata*, lengthened.
3. *Squamata*, scaled.

LXXVII. *Jania*, meaning obscure.

1. *Rubens*, red jania.
2. *Corniculata*, little-horned.

CORALLINA OFFICINALIS.—*Harv. Phy. Brit.*

LXXVIII. *Melobesia*. Name from one of the sea-nymphs of Hesiod.

1. *Polymorpha*, diversified.
2. *Calcarea*, calcareous.
3. *Fasciculata*, small bundle.
4. *Agariciformis*, mushroom-formed.
5. *Licheniformis*, lichen-formed.
6. *Membranacea*, membranaceous.
7. *Farinosa*, powdery.
8. *Verrucata*, warted.
9. *Pustulata*, blistered.

FAMILY XVII.—RHODOMELEÆ.

LXXIX. *Odonthalia*. Name derived from two Greek words, tooth and sea, meaning a toothed sea-plant.

1. *Dentata*, toothed odonthalia.

LXXX. *Rhodomela*, meaning undefined.

1. *Subfusca*, spread abroad.
2. *Lycopodioides*, probably wolf-eyed.

LXXXI. *Bostrichia*. Greek word signifying a curl of hair, or ringlet.

1. *Scorpioides*, scorpion-tailed.

DASYA COCCINEA.—Contributed by Dr. Cocks, Oct. 1845.

LXXXII. *Rytiphlæa*. From two Greek words, signifying a wrinkle and bark, because the surface is transversely wrinkled.

1. *Pinastroides*, rytiphlæa-feathered.
2. *Complanata*, smooth.
3. *Thuyoides*.
4. *Fruticulosa*, shrubby.

LXXXIII. *Polysiphonia*. From two Greek works, signifying many tubes.

1. *Parasitica*, parasitic polysiphonia.
2. *Subulifera*, thorny.

3. *Spinulosa*, small-spined.
4. *Atro-rubescens*, dark-red.
5. *Nigrescens*, swarthy.
6. *Furcellata*, small-horned.
7. *Fastigiata*, tufted.
8. *Richardsoni*, the Richardson.
9. *Griffithsiana*, the Griffith.
10. *Carmichaeliana*, the Carmichael.
11. *Brodiæi*, the Brodie.
12. *Fibrillosa*, straw-coloured.
13. *Violacea*, violet-coloured
14. *Variegata*, variegated.
15. *Grevillii*, the Greville.
16. *Fibrata*, fibrous-branched.
17. *Stricta*, ridged.
18. *Pulvinata*, dusty-looking.
19. *Obscura*, obscure.
20. *Formosa*, the beautiful.
21. *Urceolata*, hair-like.
22. *Elongata*, lobster-horn.
23. *Elongella*, elongated.
24. *Byssoides*, tufted.

LXXXIV. *Dasya*. From a Greek word, signifying hairy

1. *Coccinea*, scarlet-robed dasya.
2. *Ocellata*, eye-like spotted.
3. *Arbuscula*, tufted.

CHAPTER VII.

COME, stand with me, and let us watch the tide
Obey that mandate which restricts its progress:
Nay, sendeth back the proud waves, should they venture
Beyond their boundary, though it be soft sand.

SEE you not that jagged rhodomenia (*R. laciniata*), one of the most conspicuous among our native species? Its bright clear red, varying to the deepest crimson, vividly contrasts with the dark, weather-beaten rock to which it clings, and the huge masses of lichen-dotted stones that strew the beach. Let us watch the ebbing of the tide; and yet, so gently and imperceptibly retreat the scarcely heaving waters, that while we are speaking a change commences. We no longer look down on a mirror-like surface, which reflects every passing cloud or bird, or the beetling crags, with their light wreathing mists, but rather on a firm belt of sand, covered with sunken rocks.

Poets have sung concerning the effect produced by mountain mists, when gathered thickly on rugged heights, or floating lightly around green hills, till, melting before the beams of the rising sun, they reveal the grandeur of the one or the sylvan beauty of the other. But not less worthy of regard is the gradual receding of the tide from off a coast, rich in marine productions, when small coves, or deep-sea basins, formed by sunken rocks, are gradually rendered visible, and sea-weeds, deposited by the receding waters, are spread, as if in triumph, on the shores, or else revealed in their native growing-places; where, too, the little zoophyte opens her mimic blossoms to the sun, as if rejoicing in the consciousness of existence.

The tide is gone far out, and yonder appears another tuft of the jagged rhodomenia, lifting its bright head above the receding waters. Its ample leaves are fully developed,

dripping and sparkling with augmented beauty; and around it are a wild brotherhood of stones, covered with the deep-green, oozy weed of ocean.

Men speak of trials in this probationary state. Doubtless there is much to call for sympathy and aid—and blessed are those who sow beside the waters of affliction; yet, still there is a vast amount of happiness, concerning which few take note. Think you not that marine insects which find their homes on the broad leaves of that magnificent sea-plant are unsusceptible of happiness; that the bright beams of the warm sun are not to them an additional source of enjoyment: or that the overspreading of the waters, when they cover again, as with a mantle, the plants among which such insects dwell, does not produce a grateful and necessary change? The microscope has revealed much concerning the haunts and habits of those small creatures which are assigned to all land-plants; and, doubtless, sea-weeds have each some occupant which, equally with its terrestrial brethren, has an allotted duty to fulfil in the economy of nature.

The jagged rhodomenia offers another instance of prescribed locality, for its place of growth is uniformly on marine rocks or stones, or the strong stems of the *laminariæ*, but rarely within tide-mark. And, thus enlivening many a sea-girt rock with its crimson tufts, it extends along our shores, from the Orkneys to that extreme point in Cornwall, the Land's-End, where the sternness of rock and flood contrasts with the repose and beauty of this bright plant, over which the waves of a raging sea often rush with tremendous fury. It is also aboriginal in Ireland and Jersey; but its wider range are the Atlantic shores of Europe, reaching from Spain to Norway; those of the Feroe Isles, and the eastern coasts of South America, far south as the Delaware.

Frequent on the shores of Britain, and the south and west of Ireland, appears the hairy rhodomenia (*R. ciliata*), which, unlike its brilliant relative, is of a dull and purplish red. This plant, extending farther in its geographic range,

diversifies the sterile rocks of Greenland and Iceland, and, though rare in Scotland, is found occasionally in Iona, that celebrated island with its rocks and ruins, and tombs of men who preserved the light of Christianity from being extinguished amid the darkness of Europe. Associated, therefore, with that sea-girt isle and its memorial tombs, is this small plant, growing at one time on rocks, at another in some clear rock-basin, beside which, as tradition tells, Columba used to watch the setting sun when tinging the waves of the Atlantic with its golden hue.

Few plants are more sportive in appearance than the maned rhodomenia (*R. jubata*), and specimens are found which differ considerably from the general type. It seems, also, as if the same diversity of character was conspicuous throughout, for the plant changes quickly in fresh water; the dull red colour becomes orange, then brown, and when placed under pressure, though readily adhering to the paper, it shrinks considerably. And yet, however varying in appearance, it is readily distinguished from the hairy rhodomenia by greater stiffness of texture, and a brighter colour; it is likewise a summer plant, while the maned attains perfection in winter.

Found equally on the Atlantic shores of Europe and those of the Mediterranean, its place of growth is the stony bed of rock-pools, into which the tide often rushes with great force; and hence, probably, the densely-matted and branching fibres, which enable it to adhere firmly to its pebbly or rocky domicile.

The broadly membranaceous hand-shaped rhodomenia (*R. palmata*), with its coriaceous fronds, of which the substance in large varieties is leathery, in smaller rather curious than beautiful, is frequent on the British coasts, and ranges equally throughout Northern and Arctic Europe, progressing from temperate to ice-bound rocks, covered with snow that never melts, beneath which the seal and walrus find a shelter. Voyagers relate that the hand-shaped rhodomenia spreads

its dull red fronds within tide-mark along the coasts of Iceland and Kamtschatka, Greenland, and the Kurile Isles, running from the southern promontory of Kamtschatka to Japan; as likewise on the eastern shores of North America, Unalaschka, and Jasmania. Botanists consequently infer that a species thus widely extended is designed to subserve some purpose of universal importance. Borrowing an analogy from terrestrial plants, and applying the knowledge thus obtained respecting things well known to such as from their watery location necessarily remain obscure, they conjecture that the hand-shaped rhodomenia either shelters marine insects which serve as food to the finny tribes, or else that they afford pasture to those innumerable shoals of herrings, and different species of migratory fish, which annually resort to their sterile growing-places.

Three distinct forms are comprised under the general appellation of the hand-shaped rhodomenia, the well-known Dulse of the Scotch, and the Dillisk of the Irish. Young botanists would hardly suppose that they pertain to the same plant, and yet they by no means exhibit the extreme of variation; for some specimens are more simple than the one, and more finely divided than the other. Such varieties when dried occasion no small difficulty in tracing the limits of the species; but if a collector has once seen and tasted a specimen of dulse when taken from the water, he has no difficulty in recognizing the plant, however differing in appearance. And not less curious is the fact, that if the dulse grows on rocks, its fronds are broad, and slightly divided; but if attached to the serrated fucus, they prove that this widely-diffused sea-weed derives a peculiar character from the parent plant. Harvey further mentions that his own experience restricts the growth of the common dulse to the serrated and vessel-bearing fucæ.

This valuable plant is in great request among the Scotch and Irish as a pleasant esculent, and the old cry of "Dulse and Tankle" is still heard in the streets of Edinburgh.

The variety which attaches itself to mussel shells between tide-marks is generally preferred as less rigid, while the minute shell-fish which cling to its fronds are grateful to the consumers of this simple luxury. By the Highlanders it is called Duillisk, compounded of two Gaelic words, *duille*, a *leaf*, and *uisge*, water, *i.e.* the leaf of the water. From *uisge*, according to Landsborough, is derived the word whisky, and with the addition of *baugh*, *life*, we have the usquebaugh of the Irish (aqua vitæ), "the water of life;" but with how much more propriety might it be termed "the water of death!"

In different parts of Ireland, the same marine plant is known by the appellation of Dillisk, which also signifies the leaf of the water, for *esk* means water, and hence the many rivers which bear in Scotland the name of Esk. Those who dwelt beside the coasts where grew the dulse, used in old times to dry that plant in the sun, and, having rolled it firmly together, to smoke it instead of tobacco. Happy would it have been for many if they had adhered to the plant of their own shores, which, instead of being hurtful, is both wholesome and pleasant, especially when taken fresh from the sea, as is common in the Lowlands! The same species is also carefully collected on the islands of the Archipelago, and is used in ragouts and made-dishes, to which it imparts a red colour, being equally preferred on account of its nutritious qualities and pleasant flavour. The dried frond, when steeped in water, exhales an odour resembling violets; Dr. Patrick Neill even mentions that it communicates a similar flavour to vegetables if mixed with them.

The branched rhodomenia (*R. palmetta*) is readily distinguished by its fan-like and rose-red fronds, which are more or less deeply cleft, with rounded interstices and wedge-shaped terminations, as also by deep red spots on each. Those who visit the British coasts in quest of Algæ, may often find this plant on rocks near the verge of low-water, occasionally at a greater depth, adhering to the

stems of the *laminaria digitata*, or sea girdle. Sidmouth is one of its most favourite haunts ; and beautiful is the effect which it produces when seen through a clear transparent medium, affixed to some dark and rugged sea-rock.

A small brotherhood is that of rhodomenia, and yet comprising much of beauty and variety. Varying in colour from the brightest pink to dull red, they claim by this heraldic hue their relationship to the red series rhodospermeæ ; a colour rare within the tropics, and still more uncommon in polar latitudes, but which especially belongs to the temperate zone, of which the members are most luxuriant in form and rich in species from the 55th to the 45th degree of latitude, but rapidly diminishing towards the Equator after passing the 35th.

With regard to such of this beautiful and infinitely varied series as pertain to the shores of Britain and her immediate dependencies, we may briefly note that they attain the highest perfection in deep water. When occurring above half-tide level, they assume either purple, or orange, or yellow tints, occasionally even a cast of green : and are rarely of a bright hue within the range of extreme low-water mark, above which many of the more delicate species refuse to vegetate, while such as still exist degenerate both in form and colour.

Let not the algologist object that the brilliant family of rhodomenia has taken precedence of their unassuming elder brother, the purple hypnum (*Hypnea purpurescens*), thus named from its moss-like character. The eye resting on their beauty, caused this departure from prescribed rules of precedence, and hence it happened that the *hypnea* was passed by. But that tribe, however humble, must not remain unnoticed. Analogous to creeping plants, which lift themselves ofttimes into air and light by the aid of clasping tendrils, the hypnum has its screw-like fibres, with which to lay hold of rough projections on sea-rocks, and thus preserves a tenacious grasp amid the strife of

waters. Hence its wide dispersion along the shores of the North Atlantic.

The Compressed Gracilaria (*Gracilaria compressa*) is restricted, on the contrary, to the coasts of Europe, and its beautiful companion, the Erect Gracilaria, is found, though irregularly, in the same locality; at one time delighting the searchers after curious specimens, at another sought for in vain, and remaining absent during many years. This peculiarity of profuse recurrence and disappearance may be readily explained. Changes occur in the bed of ocean, produced by inundations of sand and gravel, brought by tributary rivers from the sides of mountains, and overwhelming such marine meadows as spread contiguous. Thus, for example, scarcely has the Rhone passed out of the Lake of Geneva, before its pure waters are filled with sands and sediments by the impetuous Arve, which, descending from the highest Alps, bears in its current the granitic wrecks that are annually brought down by the glaciers from Mont Blanc.

But wherever found, the Compressed Gracilaria is uniformly discovered among marine deposits, cast up from deep waters; and Harvey consequently infers that its growing-place lies hid in the bed of ocean. This curious plant bears a close resemblance to the *G. lichenoides* of the East Indies; and Mrs. Griffith, believing the plant to be identical, prepared from it a pickle and preserve, which proved excellent in flavour, as well as ornamental, thus proving that our native plant is equally as valuable as its Indian relative.

Restricted by its geographical distribution to the shores of France and England, the rare and elegant Erect Gracilaria (*G. erecta*), which is yet scarcely known beyond the precincts of our own country, was long familiar under the manuscript name of *Suffocatus*, a name designed to express its frequent place of growth in shallow rock pools, where it is found half buried in sand. Occasionally, however, the same plant may be seen peeping forth from amid the sand,

when the tide is out, but more frequently it is dredged from four or five-fathom water.

Different species of the family of Rhodomenia, connected with the present series, crowd before the mental view, but while looking over notes made at various times we shall briefly select a few of the most conspicuous. Among such the red dock-leaved Delessaria (*D. sanguinea*) is entitled to rank high in the oceanic flora; and notwithstanding its common occurrence on our shores, is never seen without attracting admiration. In favourable localities, at Scarborough and Yarmouth, Falmouth Bay and the Scilly Isles, specimens are seen occasionally of gigantic size, while the length and breadth of its delicately membranaceous, yet glossy and shiny leaves, render it one of the most beautiful objects in nature. As a type therefore of its genus, the red dock-leaved Sanguinea worthily commemorates the services rendered to marine botany by her most distinguished votary, whose loss was deeply felt, and whose place in the wide circle of which he was the centre can never be supplied.

The absence of a nerve distinguishes the genus *Nitrophyllum* from the preceding, as do the thinner, more reticulated substance, and distinct spots of granules, from the brotherhood of Rhodomenia. Marine botanists, therefore, who seek for the six members of this pleasing genus on the coast of Devonshire or Cornwall, where they obtain a full development, will do well to bear their distinctive peculiarities in mind. Such also is the favourite haunt of the blunted Laurencia (*L. obtusa*), which, in common with its brethren, recalls to mind the name of M. de la Laurencie. In colour a fine but fleeting pink, it is said to emit the scent of violets; and those who gather it along our shores are thus often pleasingly reminded of green fields and banks where grew the favourite flower of their childhood. And yet, though beautiful in its assigned locality, conspicuous too, being from three to six inches high, it may not compare

with the Spotted Nitrophyllum (*N. punctatum*), either in size or hue. That plant, "beloved the most" by those who seek for marine productions, either in their ocean sites or sterile growing-places, is common to the coasts of England and Ireland, with those of Scotland, far north as the Orkneys, and attains to a gigantic size at Cushendall Bay, in the west of Ireland. What think you of a sea-plant five feet long by three feet wide, of a delicate rose-pink colour, spotted with capsules and sori of a darker hue? Such is the Spotted Nitrophyllum, of which mantles might be formed, worthy to adorn the Nereides in their mossy halls, or, in days long past, the sea-green sisters of Cyrene, when beneath the classic waters of Pineus—

> "One common work they plied; their distaffs full
> With carded locks of blue Milesian wool."

CHAPTER VIII.

> "ART's finest pencil would but rudely mock
> The beauteous corals border'd on a rock;
> And those grey watery grots he would explore,
> Small excavations on a rocky shore,
> That seem like fairy baths or mimic wells,
> Richly emboss'd with choicest weeds and shells,
> As if her wonders Nature chose to hide,
> Where nought invaded but the flowing tide."

WHAT see you on this wild sea-rock round which the clear transparent sparkling waters gently swell and ripple? A specimen of the *Corallina officinalis*, or medicinal coral, the type of a beauteous family, which has long engaged the attention of naturalists, and whose place in marine botany is now accurately defined. This interesting species forms,

with its relatives, a distinct family, and derives its specific name from *coralium*, or coral, which it resembles in being of a stony nature, although decidedly vegetable; for whoever macerates a specimen in acid till the lime which it contains is dissolved will discover that it is essentially different from coral, although analogous to many Algæ.

Corallines, widely diffused throughout the shores of all countries within the temperate zones of the Northern Atlantic, perhaps even along those of the Southern and Pacific Oceans, appear at first as thin calcareous and circular patches of a purplish colour, attached to almost every stone or seaweed between tide-marks. By degrees, small branches become perceptible; the root assumes a decided character, and the fronds, from one to six inches high, congregate in dense tufts, or spread in continuous patches over a wide surface, differing as respects their general aspect according to the depth at which vegetation generally commences. Few plants present a greater variety, and few are more difficult to specify. They vary both in size and structure, for Nature is ever prodigal in the profusion of her embellishments,

> "Some present
> Large growth of what may seem the sparkling trees,
> And shrubs of fairy-land; while others shine
> Conspicuous, and in bright apparel clad,
> And fledged in snowy feathers, nod superb."

The coast of Devon yields an exquisite variety of these marine productions. They are often left by the receding of the tide upon the shore, and as often float by on the sparkling waves. Some appear like little tufts of grass, borne hither and thither by the billows; others resemble bunches of hair-like tubes, varied with rainbow tints; a few may be compared to clusters of diminutive beads; and a large proportion to long brown filaments, covered with a calcareous crust.

The favourite locality of the medicinal coral is pools or rocks between tide-marks; while its brother, the scaly coral, is seen on submarine rocks at the extremity of low-water mark throughout the southern coasts of England. Miltown Malbay, Youghal, in the west of Ireland, and Jersey, are its frequent growing-places, and in these it attains a full development, being readily distinguished from the medicinal, chiefly by the construction of the upper joints of the stem and branches, which are broad and flat, with prominent and usually sharp angles.

Modern algologists have separated the *Corallina corniculata*, or little-horned coralline, from its brethren, and given it the appellation of *Jania corniculata*,—*Jania* being derived from Janera, one of the Nereides; and *corniculata* from its peculiar construction. The species is generally parasitic on smaller Algæ in rock-pools between tide-mark, and is found on the southern coasts of England and Ireland, as also, in its wider range, throughout the shores of the Atlantic and the Mediterranean.

A separation has also been made with regard to the *Griffithsia corallina*, or coral-like Griffithsia, of which the generic name is given in honour of Mrs. Griffiths. This most beautiful, and yet not very uncommon plant, can hardly fail to attract the notice of those who study the marine Flora. Hence it was figured by Dillenius among the few ocean plants which he has preserved. Linnæus also, in his wanderings along the shores of the Arctic regions, was often cheered by the sight of its clear red-beaded fronds.

Pleasingly associated with the name of Icolmkill, is the *Melobesia polymorpha*, or diversified Melobesia; a species of coral which grows best on submarine rocks, and in quiet bogs, and is yet so abundant in the Orkneys as to warrant the conclusion that it might be advantageously employed for agricultural purposes, and for building, especially as limestone is scarce, and generally of bad quality, in the

island. St. Columba knew its value when he constructed a cathedral in Iona. The cement employed by his workmen was formed of lime calcined from sea-shells, and made into rough mortar, with a large proportion of coarse gravel, and fragments of white coral, which abounds along the shores. And so strong is this cement, that more readily might the stones be broken than forced asunder. Yet the Diversified Melobesia is delicate in its formation, and scarcely might the looker-on conjecture that latent powers were concealed in its irregularly-lobed fronds. Those fronds, when thrown upon the shore, become bleached in the sunbeams, but when newly dredged, they are of a reddish purple. The elegant *Lima tenera* nestles among them, and, like the builders who wrought in the cathedral of Icolmkill, employs small pieces of detached coral in constructing his submarine grotto. And wondrously is the grotto wrought; for the Lima, its inhabitant, is not only a mason, but a rope-spinner, a tapestry-weaver, and a plasterer. Each of these dissimilar occupations is required; for were the creature merely an adept in the mason's craft, he might not cause the fragments of coral to adhere. Cordage, therefore, is required to bind together the angular pieces; and this cordage he readily spins, although its mode of spinning is among the secrets of the deep. Men require hands with which to produce cordage, but the lima does without them, and contrives to intertwine the yarn among innumerable bits of coralline till they are bound together. This habitation is rough externally, and therefore better fitted to elude the enemy; but within, the case is otherwise. The walls are beautifully smooth, for the yarn is woven into tapestry, and all interstices are filled with lime, till the whole resembles fine plaster-work, not unlike the patent Intonaco of Mrs. Marshall. And thus the ingenious inhabitant dwells securely amid the waters, in a grotto lined with tapestry, where no jutting points may injure his tiny form. Tapestry, as a covering for walls,

was once the proud and costly ornament of regal halls; but our little marine weaver, as the author of "Excursions to Arran" has observed, derived no hints from the Gobelins, nor from the workmen of Arras, nor from those of Athens, neither from the earliest tapissiers of the East. From the time that Noah's ark rested on the mountains of Ararat, the forefathers of the beautiful little limas constructed their coral cottages, and lined them with well-wrought tapestry in the peaceful bay of Lamlash.

Plants pertaining to the family of *Rhodomeleæ* are in general slight and elegant, often feathery and brightly tinted; and the sites they occupy are not unfrequently in accordance with their delicately-ramified fronds. Thus the smooth Rytiphlæa (*Rytiphlæa complanata*) is found amid the loveliest of ocean scenery, on the pebbly beds of clear rock basins, exposed at low-water to full sunshine. Harvey speaks of having noticed this plant in considerable abundance at Miltown Malbay, where it clothed the rocky base of a tide-pool four or five yards in diameter, and from three to six inches deep. The collector of marine plants will do well to remember that the species, unless allowed to remain for some hours in fresh water, will not only stain the paper of a dull brown colour, but turn black and rigid.

Few, perchance, of the elegant family of *Polysiphonia* are more pleasing than the violet-coloured, with its bushy and feathery branches and closely-connected fronds, of which each division becomes more slender, till it terminates in a number of fine ramuli, crowned with a tuft of fibres. The colour is brown-red, more or less purple, with soft irregular cells, and thus presenting an interesting type of its widely-diffused brotherhood. The *Violacea* extends throughout the shores of Northern Europe, and is found on most of our British and Irish coasts, near low-water mark. Torbay and Salcombe, with Falmouth Harbour, and Carnarvon, are the favourite growing-places of this most interesting species. The fibrous-branched, which ranges throughout the Atlantic

shores of Europe, is also common to our coasts, on rocks and mussels, in places subject to the ebbing of the tide. Beautiful in its watery locality, and affording a pleasing contrast to such green sea-weeds as grow contiguous; its brownish red branches appear, when covered with antheridia, as if crowned with tufts of golden fruit.

Another of this interesting brotherhood, the parasitic *Polysiphonia*, grows, as its name implies, on different marine productions: such especially as take root at the limit of low-water mark; occasionally even at the depth of fifteen fathoms. Hence it is that the *Parasitica* remained unnoticed, till within a comparatively recent period, and can hardly be obtained except by dredging; for who may readily examine the perpendicular sides or ledges of marine rocks? Yet, were it possible to explore the growing-places of this interesting species, we should often find them on marine ledges, covered with the *Corallina officinalis*, to which they cling like the lesser Dodder, that bright red cobweb-looking plant, which conceals, as with a gauze mantle, bushes of juniper or gorse. I have seen that plant on the wild sea-cliffs of Mort—a place rarely visited, and yet but a few miles distant from Ilfracombe; and deep beside the basement of these cliffs grew, most probably, its oceanic representative; for the parasitic Polysiphonia extends from the Orkneys to Cornwall, and is nowhere more abundant than on the Ayrshire coast at Arran, and along the shores of Devonshire. At Sidmouth, also, and at Torbay, on rocks, and stones, and smaller Algæ, grows the elongated, a beautiful marine plant, which equally diversifies the coasts of France and the Adriatic. Deciduous trees, when seen in spring and autumn, are not more dissimilar in their appearance than specimens of the elongated when collected at different seasons. In spring, and during the early months of summer, its branches are clothed with numerous pencils of delicate soft rose-tinted, or blood-red ramuli; at a later period these fall away, and such plants as are collected in September or October are

usually unadorned; the larger branches alone remain, and these, in their loneliness and rigidity, with broken points and spine-like terminations, have little semblance to the plant of summer. But with the coming back of spring, attended by her mild sea-dove, and birds from far-off lands, the elongated is seen reclothed with bright-red tufts —fresh, vigorous, and beautiful, and expanding on its pebbly bed, above which the waters plash and sparkle, and give additional brilliancy to the plant that glows beneath.

The *Griffith polysiphonia*, of which the specific name commemorates its first discovery by Mrs. Griffith at Torquay, subsequently in the isle of Portland, is often found on the south coasts of England, growing upon the smaller Algæ between tide-mark. The geographic distribution of this plant has hitherto eluded the researches of botanists, although its distinctiveness from others of the name consists in a distinctly-pointed stem, with straight tubes, as also by a full red hue, inclining to brown when dry. Far, however, as the researches of botanists extend, the Griffith has been traced along the Atlantic shores of North America, of France and Spain, though nowhere more abundant than in the Mediterranean, and especially at Venice, where it recalls to mind the thought of a modern traveller, when, standing beside the pyramids of Egypt, he looked upon the grasses which grew around, verdant as when the proud dynasty of the Pharaohs filled the throne of that country, and contrasted the permanency of Nature with the mutability of earthly greatness. And thus it is as regards that ancient city, beneath the shadows of whose crumbling palaces grows unheeded the elegant *Griffithsiana*.

> "In Venice, Tasso's echoes are no more,
> And silent rows the songless gondolier;
> Her palaces are crumbling to the shore,
> And music meets not always now the ear.
> Those days are gone—but beauty still is here.

States fall and fade—but Nature does not die.
Nor yet forget how Venice once was dear,
The pleasant place of all festivity,
The revel of the earth, the masque of Italy."

In England, Plymouth is recorded as the favourite habitat of this commemorative species, of which the hue and form is little in accordance with the mud-covered banks or rocks, in bogs or estuaries, whereon it flourishes. No small degree of intrepidity is required to venture ofttimes in places which seem unlikely to reward the exertions of the marine botanist; and yet many a beauteous specimen grows best on sites which have nought of outward beauty wherewith to allure the passer-by.

The wandering scarlet-robed Dasya finds its home on the wide waters, or else is borne from out the depths of ocean, for nowhere has its habitat been discovered. The arrival of this plant upon our shores announces that either summer or autumn is begun; for punctual as the rising of their constellation, or the departure of migratory birds, first one, and then another, is deposited by the receding billows. Marine botanists hail them with great pleasure, for Dasyas are somewhat rare; and happy are those who may number these children of the deep among their specimens.

This feathery-looking plant, the loveliest of ocean tribes, seems in unison with cloudless skies and summer tides, when scarcely a breath of wind is stirring, and ocean gently swells and ripples, and spreads its gifts upon the sand. But equally in autumn comes the fairy-formed Dasya, with its brightness and its beauty, riding on those vexed and chafed surges, which the equinoctial gales have lashed into fury. To this there is no parallel among terrestrial vegetation. Such plants as grow on windy heights are generally procumbent, or cling tenaciously to their bleak habitats, or else they hasten under ground at the approach of winter. Forest trees have roots with which to grapple the strong rocks whereon they grow, but the delicate Dasya has no

such provision. Her home is on the waters, often when thunders are abroad, and fierce winds contend for mastery, when, too, the raging and recoiling of huge waves against their barrier rocks is still louder and more terrible. Many a gallant vessel, ably commanded and well manned, with its strong ribs of oak, and dauntless hearts on board, are wrecked by their fury, while the small sea-weed rides uninjured; and he who, sleepless and tossing on his bed, listens with dread to the deep thundering roar of ocean, mindful of wrecks on the wide expanse, may find next day this small plant lying uninjured on the sand.

Associations therefore of minuteness and magnificence, of helplessness and terror, are blended with the wandering Dasya. Somewhat of mysteriousness mingles also, for its home may be on the ever-moving surface of the billows—

> Up and down,
> Up and down,
> On the feathery crest of the wild sea-foam.
> Bathing now in the purest light,
> Hurrying now through the gloom of night,
> Where the surges rage and foam.

Or perchance it grows besides one of those clear streams that gush from out the bed of ocean—small sea-streams winding in their pureness and their clearness, having nought in common with the briny waters of the deep. This plant may grow beside them, or it may be in one of those untrodden caves where the sea-star sheds her mild light; a living lamp gleaming in the darkness, and flinging a soft radiance through groves of coral. Such may be her native growing-places, and as the world is full of symbols designed to awaken thoughts concerning things that are invisible, the coming up of this delicately-formed sea-weed from out her dwelling in the fathomless abyss, or else her wondrous preservation beneath crushing rains, and amid the utmost fury of fierce winds, is one of Nature's lessons whereby to gladden or console the heart of man.

CHAPTER IX.

We now pass on to a class of marine plants which botanists in former days thought unworthy of the least attention. True it is that, with few exceptions, they have little to attract attention when compared with their beauteous relatives, the family of Rhodospermeæ; yet with them are associated powers of locomotion, that occur about the time of sunrise, and cease at a later period—a natural phenomenon, pertaining to plants of a simple structure and organization, which baffles the researches of scientific inquirers, and often leaves the naturalist in doubt whether he is observing the motions of an animalcule, or those of a plant.

> "Proud reasoning man, thy soaring wing
> Would hurry towards infinity;
> And yet the meanest, feeblest thing,
> Is too sublime, too vast for thee:
> And all thy vain imagining we see
> Lost in the smallest speck."

And how vividly is the observation of the poet brought to mind when considering the curious formation and probable use of the *Codium tomentosum*, or Woolly Codium, which rather resembles a sponge than Algæ, and which clings so firmly to its native rock as scarcely to be detached! This small plant is the home of a rare and lovely mollusc, which has some important purpose to fulfil in its unobtrusive sphere; and hence the power of adhesion possessed by the Codium in its domicile, lest the rushing of fierce waves should frustrate that destined purpose.

"Order is Heaven's first law;" manifested equally in the motions of the planets as in the arrangement of vegetable tribes. Four members only pertain to the small division *Codium*, and yet the growing-place of each one is different: the *adhærens*, a perennial plant, adheres, as its name im-

plies, to marine rocks, where it resembles fragments of bright green velvet; the *amphibium* is found on turf banks, at extreme high-water mark; the *bursa*, of which the globular frond forms a spongy and hollow ball, spreads over rocks in its favourite localities—the coast of Sussex, with those of Cornwall, Torquay, and Belfast; while the cylindrical and forked *tomentosum* dwells apart on rocks, and in rock-pools near high-water mark.

Such also is the habitat of the feathery *bryopsis*, one of the most attractive in this sea-green family. The colour is rich and glossy, the form symmetrical, and the whole plant resembles the feathers of a green parrot. And although less beautiful, being slenderer, more branchy, and of a yellower green, the *B. hypnoides* looks well in its watery location of some rock-pool, or when adhering, beyond tide-mark, to a widely-spreading and olive-brown sea-belt, the haunt of beautiful molluscs, that are seen gliding among them; or the fixed habitation of numerous zoophytes, among which the *Flustra membranacea* often covers it with fine, silvery, lace-like webs, and the *Lipralia hyalina* and *annulata* richly dot its leathery substance.

> "Huge ocean shows within his yellow strand
> A habitation marvellously plann'd
> For life to occupy."

Look narrowly into one of those clear rock-pools, near low-water mark, which are left by the receding of the tide, over which a steep mural cliff throws its shadow. Such is the frequent habitat of the rich, glossy, full-green *Cladophora falcata*, with its curled branches, and delicate ramula bending on one side. This plant, as yet without any assigned geographic distribution, and known principally in the west of Ireland, where it affects the rocks outside Dingle Harbour, is singularly beautiful, both in form and hue, and affords a pleasing object for the microscope.

The *C. Hutchinsiæ*, found also on the rocky bottoms of

clear tide-pools, is one of those memorial plants which call to mind the unwearied exertions of botanists, who first sought for them in places from which many would have shrunk. Such was the late Miss Hutchins, of Ballytichy; and fresh as the vivid and beauteous glaucous greenness of the bright Hutchinsiæ, when seen in her ocean bed, is the memory of one who loved to explore the wild haunts and rocks of her locality, and whose name is held in grateful remembrance by botanists of all countries. To her the botany of Ireland owes much, especially the cryptogamic branch, which had been little explored; and hence the genus Hutchinsiæ, consisting of various Alpine species of cruciform plants, is dedicated to her memory by R. Brown, the prince of botanists. Hence, also, Agardhi, the great Swedish algologist, selected the beautiful and extensive genus now called Polysiphonia, with a similar design. Nor was it solely to marine plants that her researches were extended; every department of Natural History was studied with equal avidity. The fishermen often saw her at early dawn seeking among the deposits of ocean for whatever of "beautiful or new" had been left upon the sand; and the peat-cutter, on many a bright morning, when dew lay heavy on the grass, and light wreathing mists floated on his native hills, saw her light form tripping from glen to moor in quest of insects or of flowers.

> "In every season of the beauteous year,
> Her eye was open, and, with studious love,
> Read the divine Creator in his works.
> Chiefly in thee, sweet Spring, when every nook,
> Some latent beauty to her wakeful search
> Presented, some sweet flowers, or virtual plants;
> In every native of the hill and vale
> She found attractions; and where beauty fail'd,
> Applauded fragrance, or commended use."

The geographic range of the spreading *Cladophora*, which closely resembles the Hutchinsiæ, extends to the Mediter-

ranean, and affects in England a similar locality. Those who seek on rocks, or in pellucid basins, for the elegant Hutchinsiæ, often regret to find the one, where they would gladly have hailed the other. When seen under water, the resemblance is considerable, both in form and hue, though, in general, the spreading Cladophora is a much larger and stronger plant.

Equally abounding on all our rocky shores, from Orkney to Cornwall, ranging also amid the wild wave's play throughout the Atlantic coasts of Europe and North America, with those of the Baltic, Dr. Hooker speaks of the *C. arcta*, as growing profusely in the Falkland Islands, and he conjectures that it is distributed in all southern latitudes, wherever a similar climate prevails. Those who seek for this rich deep-green and tufted species may generally find it on exposed submarine rocks, within the range of the tide, nearly at the limit of low-water mark; and in such places it often covers a considerable surface. When young, the colour is peculiarly vivid; and in spring, few objects are more attractive, on account of their lively green, and the fine, silky, silvery gloss with which the tips are adorned. But when old, the Arcta has little of outward beauty; the branches become more or less membranaceous, the bright colour lingers only at their tips, and when the summer months verge on those of autumn, the whole plant becomes coarse and woolly, no trace remains of its youthful beauty; and hence marine botanists, in former days, when the science was imperfectly understood, assumed that the Arcta, in its stages of growth and decay, were different plants, and gave them the names of *Vaucheriæformis* and *Centralis*.

The pellucid Cladophora clings, in its distinctiveness, to the bottom and sides of deep rock-pools, between tide-marks, in places which are not liable to be left dry by the receding of the tide. Though occasionally mistaken, at first sight, for others of the same tribe, it has yet one distinctive mark, in a single cell being found intervening between each fur-

cation. No other British species regularly exhibits the same peculiarity; and equally curious is the fact that each cell is of extraordinary length—those in the lower portion being occasionally more than an inch in length, and bearing a great resemblance to the articulations of some grasses. This peculiarity of structure has, doubtless, an important reference to the watery locality of the *pellucida*, which extends throughout the Atlantic shores of Europe and America, the Mediterranean, and Cape of Good Hope.

Our rocky shores are also varied with the beautiful rock-adhering Cladophora, which extends throughout every European coast, even into the belt of the Laminariæ. Few plants are more dependant for their greenness and luxuriance on the ocean sites which they chance to occupy. Near high-water mark they present the aspect of plain-looking plants, closely tufted, and of a cloudy and disagreeable greyish-green; but when growing in deep water they are beautiful, and reflect glaucous tints, and, according to their ocean site, so is their power to attract the eye. Specimens gradually increase in luxuriance, and in the depth and purity of their rich dark-green hue, as they recede from high-water; and, were it possible to follow them where, as yet, the foot of man has never trod, we should, perhaps, find that none of their ocean brethren may vie with the rock-adhering Cladophora. Those ancient botanists, Theophrastus and Dioscorides, though, in general, regardless of marine plants, mentioned this handsome species as diversifying the coasts of Lesbos, and those of the Mediterranean over-against Cyprus. And still the same plant, with its deep-green tufts, and short filaments, curled and matted together, is seen in the same locality, as also on the Atlantic shores of Europe, and the Baltic. But, though attaining its full development in clear bright waters, the rock-adhering Cladophora was discovered by Hawkins, on submarine peat, at Birturbui Bay, in Connemara; it grew in patches on the naked surface, just within the limit of the tide—a strange habitat,

and most unlike its general haunts, yet showing that the species was struggling hard to extend its place of growth.

> "It seems as if these wondrous plants had thought,
> And power to choose out places for their growth:
> As if they sought to bless the homeliest haunts,
> And clothe the rock with beauty; bidding men,
> Passing perchance in haste, to pause, and think
> Of Him who made them, and look scorn no longer
> On lowlier ones, whom the Most High hath placed
> In fitting stations."

The trivial name of *Linum* aptly expresses the peculiar character of this curious plant. Its pale or dark-green floating filaments vary from a few inches to several feet in length, and are disposed in strata, lying one above the other. Lowly is its habitat, whether in salt-water ditches on our coasts, or among rocks and huge stones along the shores of Europe; and yet, how much of beauty is discovered in this humble weed! how curiously jointed is each filament with dense articulations, containing fluid that ministers, without doubt, to the exigencies of the parent plant!

A peculiarly pale, or rather a fine yellow-green colour, and a bushy mode of growth, distinguish the soft and membranaceous *C. lætivirens*, which is found on rocks and stones throughout the Atlantic shores of Europe and North America, but uniformly in the open sea, and beyond the influence of fresh water. The *C. glomerata*, on the contrary, is seen in rills and rivers remote from the sea, and often in such as have their source in mountainous regions.

Assigned, with their brethren, to embellish the beautiful solitudes of nature, on sea-rocks around which the breakers lift their crests of broken foam; to call forth thoughts of love and thankfulness in those who visit the wild sea-shore, when looking over its might of waters, and contrasting them with the minuteness or the beauty of marine productions, different members of the family of Cladophora are found in almost every part of the known world, with the exception

of the *C. glaucescens*, a species, as yet, considered peculiar to the British Isles, and of which, in Devonshire, Torquay, and Falmouth—in Ireland, Portmarnock, and the rocks beyond Kingstown Harbour—are mentioned as places of growth. Algologists, though little skilled in the peculiarities of the Cladophora tribe, may readily distinguish this elegantly tufted species by its glaucous hue when fresh, by the slenderness of its filaments, and the uniform length of the articulations throughout the stem. The *uncialis*, common to the shores of Northern Europe, has also its peculiar characteristics, and, though resembling the *lanosa* more nearly than any other of our native species, yet forms more dense and rope-like tufts, which become inextricably woven. Its habitat affords another clue; for it frequents rocky places, clinging to the surface of the rock, or nestling in the thin coating of sand which verges to the edge of low-water mark; while the *lanosa*, on the contrary, is almost uniformly parasitic on other Algæ, or else attached to pieces of wood, or the leaves of the Zostera.

Series III.—Chlorospermeæ.

grass-green series.

Plants growing in the sea, in fresh water, or in damp situations; either filamentous, membranaceous, or shapeless; either colourless, or, owing to the presence of an internal granular sporular mass, of a grass-green, very rarely purple or red colour. Fructification, green or purple sporules, either filling the frond, or collected into sporidia, rarely contained in external capsules.—*Harvey.*

Family XVIII.—Siphoneæ.

LXXXV. *Codium.* Name from a Greek word signifying the skin of an animal.

1. *Bursa*, purse-shaped codium.
2. *Adhærens*, adhering.
3. *Tomentosum*, woolly.
4. *Amphibium*, amphibious.

LXXXVI. *Bryopsis.* From two Greek words signifying the appearance of a moss.

1. *Plumosa*, feathery bryopsis.
2. *Hypnoides*, moss-formed.

Bryopsis Plumosa. *Portincross, Ayrshire.* Contributed by the Rev. D. Landsborough, A.L S.

LXXXII. *Vaucheria.* Name given in honour of M. Vaucher, a distinguished naturalist, author of "L'historie des Conferves d'Eau douce."

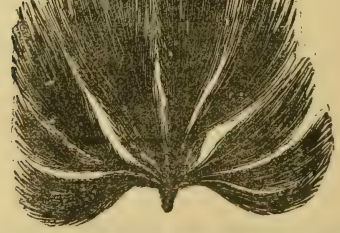
1. *Submarina*, submarine Vaucheria.
2. *Marina*, marine.
3. *Velutina*, veiled.

Family XIX.—Conferveæ.

Plants growing in the sea, or in fresh water; filamentous, articulate, without defined gelatine.

LXXXVIII. *Cladophora.* Signification of the name, branch-bearing; *Conferva* being retained for the species with simple filaments.

1. *Brownii*, the Brown cladophora.
2. *Pellucida*, pellucid.
3. *Rectangularis*, right angle.
4. *Maccalana*, the McCalla.
5. *Hutchinsiæ*, the Hutchins.
6. *Diffusa*, the diffuse.
7. *Nuda*, the spread-open.
8. *Rupestris*, dark green rock.
9. *Lætivirens*, light-green bushy.
10. *Flexuosa*, curled.
11. *Gracilis*, slender.
12. *Rudolphiana*, the Rudolph.
13. *Refracta*, broken.
14. *Albida*, whitish.
15. *Lanosa*, woolly.
16. *Uncialis*, inch-breadth.
17. *Arcta*, arctic.
18. *Glaucescens*, sea-green.
19. *Falcata*, hooked.



CLADOPHORA ARCTA. *Kingstown.* Contributed by **N. T. C.,** *Dublin.*

LXXXIX. *Rhizogonium.* Name derived from the root-like form of the branches.

1. *Riparium*, river-bank rhizogonium.

XC. *Conferva.* Name from *conferruminare*, to consolidate.

1. *Arenicola*, sand-growing conferva.
2. *Arenosa*, sandy.
3. *Lettorea*, sea-shore.
4. *Linum*, flax.
5. *Sutoria*, stitch-like.
6. *Tortuosa*, twisted.
7. *Implexa*, plaited.
8. *Melagonum*, dark offspring.
9. *Ærea*, sand-loving.
10. *Collabens*, prostrate.
11. *Bangioides*, the Bangor.
12. *Youngana*, the Young.

Family XX.—Ulvaceæ.

Plants growing in the sea, of a membranaceous substance, and imperfectly reticulated structure.

Frond, remarkably thin, either a tubular, or flat-filiform, or expanded membrane; colourless, or, owing to the presence of fructification, of a green or purple, (rarely) pinkish colour.

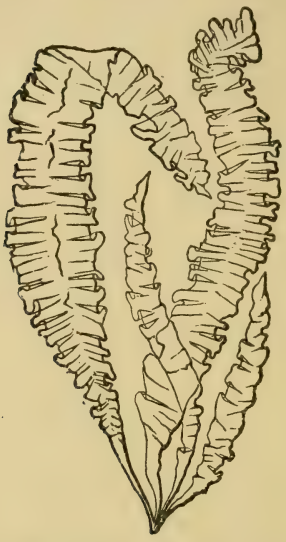
Fructification, minute green or purple granules, scattered through the frond, or arranged in fours.—*Harvey.*

XCI. *Porphyra.* Purple, from the colour of most of the species.

1. *Laciniata*, cleft porphyra.
2. *Vulgaris*, common.
3. *Miniata*, red tinted.

XCII. *Bangia.* In honour of Hoffman Bang.

1. *Fusco-purpurea*, brown-purplish Bangia.
2. *Ciliaris*, the eye-lash.
3. *Elegans*, elegant.



Ulva Linza.—*Harv. Phy. Brit.*

XCIII. *Enteromorpha.* Name signifies, in the form of an entrail.

1. *Cornucopia*, the cornucopia enteromorpha.
2. *Intestinalis*, intestinal-like.
3. *Compressa*, compressed.
4. *Linkiana*, the Linkiana.
5. *Erecta*, erect.
6. *Clathrata*, cross-barred.

7. *Hopkirkii*, the Hopkirk.
8. *Ramulosa*, small-branched.
9. *Percursa*, running.

XCIV. *Ulva*. Name from the Celtic word *ul*, water.

1. *Latissima*, wide ulva. "Green Stoke."
2. *Lactuca*, lettuce. "Oyster Green."
3. *Linza*, the Linza.

FAMILY XXI.—OSCILLATORIÆ.*

XCV. *Rivularia*. In allusion to the fresh-water habitats of many of the species.

1. *Nitida*, shining rivularia.
2. *Applanata*, flat.
3. *Atra*, black.
4. *Plicata*, folded.

XCVI. *Schizothrix*. Name derived from two Greek words, signifying to divide and a thread.

1. *Cresswellii*, the Cresswell schizothrix.

XCVII. *Calothrix*. Signifying beautiful hair, the filaments being very slender and delicate.

1. *Confervicola*, conferva-like calothrix.
2. *Luteola*, yellowish.
3. *Scopulorum*, clustered.
4. *Fasciculata*, bundle-like.
5. *Pannosa*, wrinkled.
6. *Hydnoides*, swelling-formed.
7. *Cæspitula*, turf-like.

XCVIII. *Microcoleus*. Name from two Greek words, signifying a small branch.

* The plants of the two remaining Families being generally Microscopic, we have not illustrated them.

1. *Marinus*, marine microcoleus.
2. *Anguiformis*, snake-like.

XCIX. *Lyngbya*. In honour of H. C. Lyngbye, author of an excellent work on the Algæ of Denmark.

1. *Majuscula*, larger Lyngbya.
2. *Ferruginia*, rusty-iron coloured.
3. *Carmichaelii*, the Carmichael.
4. *Flacca*, frail.
5. *Speciosa*, beautiful.

C. *Oscillatoria*. Name from a Latin word, signifying to oscillate, like the pendulum of a clock, from the motion of the filaments.

1. *Littoralis*, shore-loving oscillatoria.
2. *Spiralis*, spiral.

CI. *Spiralina*. Diminutive of *spira*, a twist or curl.

1. *Tenuissima*, most slender spiralina.

Family XXII.—Nostochineæ.

CII. *Monormia*, signifying one-lined.

1. *Intricata*, intricate monormia.

CIII. *Sphærozyga*. Compounded of two Greek words, signifying a sphere and a yoke.

1. *Carmichaelii*, the Carmichael sphærozyga.
2. *Thwaitesii*, the Thwaite.
3. *Broomei*, the Broom.
4. *Berkeleyi*, the Berkeley.
5. *Ralfsii*, the Ralf.

CIV. *Spermosira*. From two words, signifying a seed, and a chain.

1. *Littorea*, shore-loving spermosira.

CHAPTER X.

THE land has its flowers: they adorn our gardens; they exhale their fragrance on the skirts of the woods; they defy the winds, which blow around the lofty mountain-tops; they hide themselves in rifts of the rock, or spring up amid ruins; wherever a plant can take root, Flora makes her appearance with her splendid gifts.

But ocean, too, has its radiated flowers—its asters and pinks—and far more wondrous than those of *terra firma;* for, being gifted with animal life, they can open and close at will. In our seas, the Sea Anemones (*Actiniæ*) princi-

SEA ANEMONE.

pally display all the glories of the rainbow on the submarine plains; but between the tropics, the gregarious reef-forming Corals cover the ocean-bed with a gay carpet.

The glorious picture which the Astreæ and Mæandrines unfold on the bed of the Red Sea, aroused in Ehrenberg the greatest admiration, so that he exclaimed enthusiastically, "Where is the flowery paradise which, in variety and beauty, can rival these living wonders of the ocean?"

Both the Sea Anemones and Corals belong to the widely ramifying class of true Polypes—animals of simple structure, which stand almost on the last stage of animalization. All varieties possess in common a sac-shaped body, surrounding a cylindrical cavity, which opens at top into a wide mouth. This is surrounded by a fringe of tentacles, which extend and contract voluntarily, and carry food to the hungry predacious animal. Generally, firmly attached to their place of birth, or at the most, capable of only limited motion, the Polypes are unable to procure their food by fighting, personal strength, or cunning. Just as the helpless young of the higher animals are fed by their parents, they exist on what their kind mother, the ocean, conveys to them.

Their prehensile organs are traps, and not weapons; but, owing to the countless number of creatures with which the ocean swarms, especially on the coasts and in the shallow water where they have taken up their abode, the Polypes are never in want of famous food. No lazzarone could wish a pleasanter mode of life than that of a Polype, for in it the *dolce far niente* is found in its most beautiful form.

In order that the capturing apparatus may serve its purpose perfectly, it is provided with countless small, needle-like weapons, which not merely wound the little animals that come within reach, but also poison them with an acid fluid. Woe to the small crustacean, or the tiny fish, which comes too near the outspread, radiated crown of a Sea Anemone: surrounded in an instant by a hundred arms, it is suddenly stunned, and carried without further ceremony to the gaping abyss.

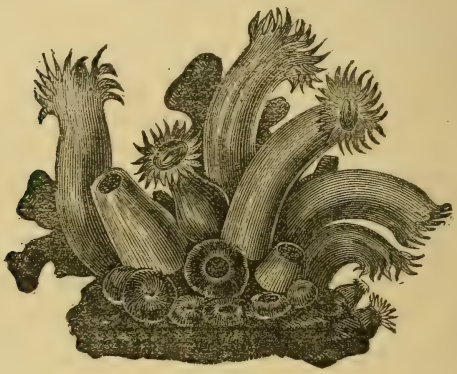
It is easily to be understood, that animals which require such a slight expenditure of intelligence for existence, have no nerves, or, at any rate, in a most rudimentary state—a negative happiness, for which many a sensitive, hysterical person, might possibly envy them.

They neither hear nor see: and, indeed, why should they? Owing to their impossible or defective locomotion, the possession of the higher faculties would be of no aid to them, to escape the attacks of their enemies just as little as it was necessary to facilitate their capture of booty, which comes to them spontaneously, without their having occasion to see or hear. The sense of feeling, which is mainly concentrated in their prehensile apparatus, and at whose signal they cling round their prey convulsively, or hide themselves, with lightning speed, on hostile contact, was evidently sufficient for all the demands of their limited existence; the more so, that it is extraordinarily sensitive of various irritating causes. The Sea Anemone *feels* the light: beneath a bright, clear sky, it unfolds all its beauty; but if a dark cloud obscure the brilliancy of the sun, the radiated crown is contracted, and the flower becomes a shapeless mass. But we should greatly err, if we thought it capable of feeling pain.

Only a few Polypes are simple and capable of movement, and among these are the Sea Anemones. Here we see a solitary flower, which springs from a simple stalk, containing a stomach. With their broad base, the Anemones attach themselves so firmly to stones and rocks, that they can only be separated from them with great difficulty, though, if they feel a fancy for moving, they can change their locality in various ways. They glide slowly and almost imperceptibly along the stalk; or, turning over, they use the tentacles as feet, or, blowing out the body with water, lessen its specific gravity, and allow themselves to be carried by the current whither it may please.

Their tenacity of life is extraordinary; and for this quality, too, they may be envied by all those who do not at all like the idea of a separation from the pleasant habit of existing and working. Let them be dipped in water, hot enough to blister the hand—let them be frozen and thawed, or place them in the exhausted receiver of an air-pump—

their powerful vital principle is victorious over all such trials. If the tentacles are cut off, they grow again; if once more removed, a fresh garland is produced. If the animal be cut in two, after a while the lower part of the body puts forth new arms, nearly as they were prior to the operation; while the upper portion continues to swallow food, just as if nothing had occurred. At first, like Munchausen's horse, it allows the food to fall out again through the open



POLYPODOM.

end; but it soon learns to retain and digest it. Johnson ("British Zoophites") even mentions an instance, in which such an amputated upper body, instead of healing at the base, formed there a new mouth, with tentacles; so that, in this way, a truly gifted double-eater was produced, which could capture and devour food at both extremities.

But these otherwise indestructible animals die at once when dropped into fresh water—for them, as for many other marine creatures, as rapid a poison as Prussic acid to man.

Sea Anemones are found in every sea, and the German Ocean has also several splendid varieties; among others, the

purple *A. equina*, which lives on rocks and reefs, and the white *A. plumosa*, whose disk, often measuring four inches in diameter, is covered with close, short, brilliantly white tentacles; but the largest and finest are found in the Tropical Ocean. Their colour is as various as the arrangement of their tentacles: there are some bright red and green, light blue and orange-coloured, yellow and milky white. At times, the tentacles from a Gorgon's head of

GROUP OF ACTINIÆ.

long thick fibres, covered with the softest velvety lustre; in others, they represent a forest of thin threads.

This race is also compelled to pay tribute to the human palate. Thus, the *Actinia fordaïca*, a handsome variety, with scarlet tentacles, found in the Mediterranean, is considered a great delicacy in Italy, and thousands of them are eaten among the other *frutti del mare*.

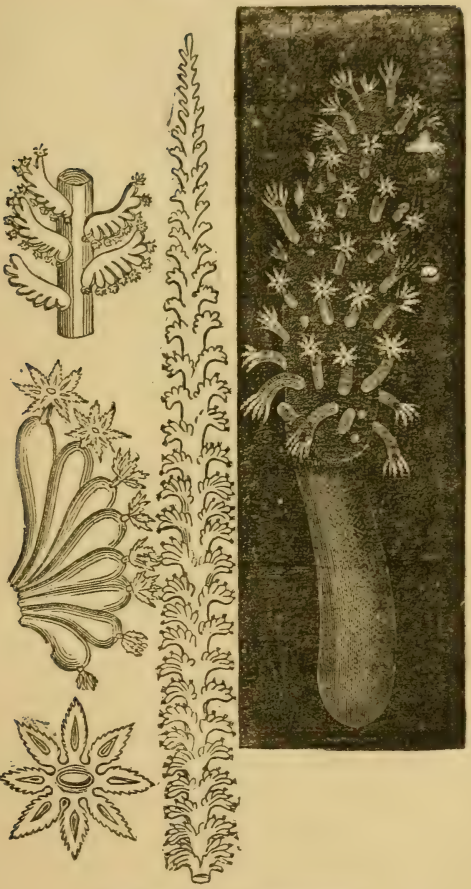
The young of the Actiniæ, which are produced from small gelatinous eggs, remain at first in the maternal cavity, where they find a sufficiency of food, and are gradually

converted, without any further remarkable changes, into the permanent form. At birth, or on emerging into the water, the only difference consists in the smaller number of tentacles, and the partition wall of the cavity.

The Lucernariæ, distinguished by a remarkable gracefulness of form, are closely allied to the Actiniæ. The bell-shaped body rises on a narrow stalk, which is usually found attached to smaller marine plants on a rocky soil. The tentacles are arranged, at regular intervals, in tufts round the edge. The crystalline animal reflects green or red tints, and can move with tolerable rapidity through the water, by alternate contraction and dilatation

The Sea-pens, and other related varieties, such as the Virgulariæ, Veritellæ, &c., seem capable of change of locality—they are composite, coralline polypes—which are not firmly attached to the ground, but only have the stalk thrust into the loose sand. The Sea-pens possess the faculty of iridescence. If irritated at any place, the light flashes from one branch and one polype to the other, till it reaches the outermost point, while all the animals beneath the irritated spot remain in darkness. If the Polypodum be thrown into a vessel of sweet water, it emits sparks from every branch, which produce a magnificent sight.

These simple or gregarious families of Polypes, like all those found in our waters, are insignificant when compared with the reef-forming Corals of the hot zone. These are propagated partly by producing small, simple, globular or oval larvæ, capable of independent movement by the possession of an external coat, which swim about for a period free, till they attach themselves with one pole of their body, and lay the foundation of a future Polyp colony. Partly, too, they multiply themselves, like plants, by gemmation, and form in this way numerous societies, whose individual members are most closely connected. Each individual has its special mouth and tentacles, and its own stomach; but it has no other specialties; for it is connected with its



STRUCTURE OF POLYPODOMS.

brethren by interminable canals and webs, so that the juices each Polype evolves benefit the entire hive. This must,

therefore, be regarded as a living layer of animal matter, which is fed by numerous mouths, and supported by an equal number of stomachs. It deserves honourable mention, that the firm calcareous skeleton is always covered by the common skin of the colony, through whose numerous openings a rich flora of radiated flowers buds.

As the Lithophytes, or Stone Corals, have a growth resembling that of plants, it must excite no surprise to find

LITHOPHYTÆ.

that they imitate all the forms of vegetation. We find among them mosses and creepers, shrubs and trees, which attain a height of six to eight feet; or graceful vases and symmetrical cupolas, which often have a diameter of ten and even twenty feet.

But all these variously-developed forms spring originally from a single spray, which, proceeding bud by bud, according to its peculiar nature, forms the broad leaf, the thin spray, or the hemisphere.

It may be said of the tropical Zoophytes, which form the wall-like Coral-reef, and in the truest sense of the term, that they build for eternity. The skeleton of the higher animals disappears from the earth in a few years; but the stone skeleton of the Polype remains firmly rooted to the

spot which it occupied during life, and serves a new generation as the foundation on which it continues building. As a general rule, all the lower strata of the larger Polypodous aggregates are dead masses. Thus, the larger hemispherical domes of the Astreæ are covered with a living layer, which is only half an inch thick; and, in some of the Porites of equal dimensions, the entire mass is found to be lifeless, except a thin external crust of about one-sixth of an inch in thickness.

We are amazed at the size of the Pyramids and primæval temples which a long-vanished race piled up on the shores of the Nile; but what are the colossal structures of the Pharaohs when compared with the mighty walls which are erected by the small weak zoophytes?

According to Darwin, to whom we owe the talented explanation of the strange forms the Coral-reefs offer, these animal edifices are naturally divided into three classes, while their physiological mode of structure always remains the same.

One description of reef is immediately connected with the continental or island shores (shore reefs, fringing reefs); to this variety belong all the Coral-banks of the Red Sea, which Ehrenberg and Hemprich investigated during eight months.

A second variety forms, at a greater distance from land, a wall, which either runs along the coasts (barrier reefs), or encloses a central island (encircling reef). Among these is the great Barrier-reef which lies opposite the north-eastern coast of Australia. According to Flinders, it has a length of nearly a thousand miles, and runs parallel with the coast at a distance of twenty to thirty miles, which, in some parts, extends to fifty or seventy.

The huge arm of the sea, formed in this manner, has an average depth of ten to twenty fathoms, which at one end, however, increases to sixty, while the open sea beyond the reef is of unfathomable depth a very short distance off. The

superficial width of the reef varies in different parts from some hundred feet to a mile. Probably this coralline wall, whose dimensions, it will be seen, laugh to scorn every human construction, is the most magnificent erection of the sort which the present epoch of creation has to offer us.

There is a large number of these island-girdling reefs, especially in the Pacific. Such, among others, is Tahiti, the Queen of Polynesia, with its girdle of palms and bread-fruit trees. This paradisaical mountainous island rises in the midst of a calm sea, which the Coral wall cuts off from the violent surf of the ocean.

The encircling reefs are found at a very great distance from the island they protect. Thus, the distance between New Caledonia and its coralline wall is no less than one hundred and forty miles.

The third variety of Coral-banks (Atolls, or Lagoon islands) differs from the former, in the fact that it does not enclose a verdant isle, but merely a central sea, or great expanse of water. Such Atolls are found close together in what is called the Coral Sea, between the northern coast of New Holland, New Caledonia, the Solomon's Islands, and the Louisiadian Archipelago; in the low archipelago, formed of eighty islands; at the Feejee, Ellice, and Gilbert Islands; in the Indian Ocean, to the north-east of Madagascar, under the name of the Atoll Group of Sayo de Malha; at the Marshall Islands (Radack and Ralick), to the east of the Ladrones; in the Maldive and Laccadive Archipelagos, and in many other parts of the tropical ocean.

Between the tropics, the constant action of the trade winds on the boundless surface of the sea produces breakers far more terrible than those of our temperate zone, and of incessant fury. It is impossible to regard these hoarsely-growling waves without entertaining the conviction that even the hardest rock must eventually yield to such a force. But the low coralline banks victoriously resist such attacks; for here a new living power enters the lists against blind

physical force. The waves may tear from the Coral-reef thousands of blocks; but what does this signify against the piled-up labours of countless myriads of little architects, who are engaged day and night in extracting calcareous atoms from the foaming waves, and arranging them in systematical constructions? Thus we see the vital strength that exists in the soft gelatinous body of a Polype conquering the gigantic power of an Ocean, which neither the works of human skill nor those of inanimate nature can withstand.

The Reef-forming Corallines, which is this way defy the utmost efforts of the waves, are, in other respects, extremely delicate and sensitive. They require a warmish water for existence, and only inhabit those seas whose temperature never sinks below 60°.

The effect of the ocean-currents has, consequently, a great influence on their appearance. At the Gallipagos, which lie below the Equator, but are exposed to the chilling influence of the Peruvian Stream, no Corals are found; while, favoured by the warm Gulph Stream, they are seen round the Bermudas, although these islands lie from four to five degrees beyond the usual boundaries of the Coral reef.

A clear unpolluted saline water is also indispensably necessary for their existence. They shun slimy, sandy coasts; and opposite flowing rivers there are corresponding holes in the reefs they throw up.

There are also many unexplained circumstances which, in some parts of the sea, favour the congregation of building Polypodoms, and in others compel their entire absence. Why, for instance, the north-western coast of Africa, St. Helena, Ascension, San Fernando, the Cape Verde islands, where the temperature is most suitable, are entirely free from Corals, which are found so frequently on the eastern coasts of Zanzibar and in the adjacent seas, no one can satisfactorily explain. As the sea is frequently fathomless at a short distance from the Coral-reef—as off the Keeling

islands, where Captain Fitzroy found no bottom with a line of 7,200 feet, scarce a mile from land—it was formerly believed that the Lithophytes built up their precipitous walls from the depths of ocean; an opinion which is no longer tenable, since Quoy and Gaymard, Ehrenberg, Darwin, and other distinguished naturalists, have proved that the depth at which the reef-forming Corallines can exist (Astreæ, Porites, Millepores, etc.), is, at the most, twenty to thirty fathoms.

Quoy and Gaymard, who accompanied the circumnavigator Freycinet on board the *Uranie* frigate, have expressed an opinion that the Corallines merely formed a proportionally thin crust on the crest of submarine chasms of mountains, or the circular edges of volcanoes; and in this manner explained, not only the remarkable appearance of the Atolls, but also the precipitous descent beyond their rings. But this theory has not stood the test of a more careful investigation; for no known crater has ever attained such an expanse as, for instance, several Atolls in the Radack Archipelago, one of which is thirty-two miles long and twenty broad.

Besides, the numerous volcanoes, on whose edges the Atolls were afterwards formed, must have all approached the surface to the slight depth in which the reef-forming Coral varieties can alone exist: a supposition which is most improbable; for where on land can we find large and broad mountain-chains whose elevations attain such an altitude?

Further, the Corals do not grow higher than to the verge of the lowest water-mark at ebb tide, or, at the most, four to six inches above it; and though the waves may pile up loosened fragments to a height of thirty feet, still they could not form Coral islands sixty feet in height, like Tongataboo, or, as at Eua, elevate the reef three hundred feet above the water-mark.

But this fact the Quoy and Gaymardian theory took as

little into account, as it did the encircling reefs that surround the lofty mountainous islands.

Charles Darwin was the first to find the key to all these geological riddles, by deducing the formation of the varying Coral-reefs from the oscillating condition of the bed of the sea, and its periodical elevations and depressions.

Just as it is now undoubtedly proved, that some portions of *terra firma* are continually rising (*Scandinavia*, *Chili*), while others are sinking (*Dalmatia*, *Greenland*), there are also rising and sinking regions in the Ocean. Among the latter, for instance, is that space, 4,000 miles long and 600 broad, on which the Society Islands and the Lower Archipelago culminate, the Coral Sea, the long chain of the Maldives, Laccadives and Chayos Atolls. If, then, we fix our attention on any one Coral-reef island in these slowly-sinking regions, we find that, while it sinks, the equally sinking Coral-reef is raised, or at any rate kept in equilibrium by the new perpendicular erections of the Corallines, which try to reach the surface. But the Corals lying near the open sea find there better nourishment than those pointing to land; the former grow quickly, while the latter pine away, and thus, with time, a reef is formed surrounding the island at a considerable distance, between which and the coast the sea is frequently found so deep that large ships can anchor comfortably in this basin, as in a harbour.

At length a period arrives when, by continual sinking, the central island entirely disappears beneath the waves, and the Atoll, or product of the Zoophytes, which labour against the sinking process, is alone left.

Hence, wherever low lagoon islands are now visible, once lofty lands rose from the sea, whose existence would be forgotten did not the Coral erections remain in evidence.

From the present size of the reefs it is calculated that the plateau which was lost in this way from the Pacific covered at least 2,000 square miles; and, as there may have been lands whose sinking proceeded too rapidly for the Corals to

hold their own on the surface, this estimate is probably far beneath the reality.

The length of time needed for the formation of these colossal Coral-banks may be judged from the fact that D'Urville found the anchors of Perouse's ships lost forty years previously off Vanikoro, at a depth of fifteen feet, covered with only a small crust of Coral, and that the anchor which Anson, the circumnavigator, left off the island of Tinian, in a depth of twenty-two fathoms, when found eighty-five years after was also merely covered with a thin layer of Coral. Thus the naturalist is shown the extreme age of our planet by the reefs of the tropical ocean.

While some portions of the bed of the sea are sinking, others again are rising. These masses of raised Coral prove that the New Hebrides, Solomon's Islands, New Ireland, the Friendly Islands, &c., are emerging from the bed of ocean.

Round Eua Island runs a Coral wall twenty feet high, in which the surf has excavated deep cavities and spouting holes. At such places the in-rolling wave produces intermittent springs, which start from the perforated rock with immense force.

Most interesting is the manner in which lagoon islands and encircling reefs eventually become the residence of man; for the Corals only build up to low-water mark, and, therefore, every tide necessarily lays their labours under water. But where the living architects falter, the destroying surf displays itself as a creative might. It tears fragments and blocks from the exterior of the reef, and hurls them a long distance over its surface. Corals, shells, and sea-urchin houses are converted, by its crushing, grinding power, into lime, which gradually fills up the interstices of the large, irregularly-piled blocks, and imparts to them greater solidity. In this manner the firm ground rises higher and higher, till at last only the spring tides submerge it. Soon, too, the tropical sun does its part in

the further construction, by bursting and exfoliating the mass rendered torrid by its beams at various places. It is then rolled higher and higher by the fierce tides; and thus a wall is at length formed which even the stormy sea cannot overstep, and behind which the fine Coral lime can collect undisturbed. Here the floating seeds and fruit, which the ocean currents often bring with them from distant latitudes, find a suitable soil, and begin to cover the glistening lime with light verdure. Trunks of trees, washed from their home-forests by floods, also drift on the shores of the newly-formed islands, and bear to it sma animals—insects or lizards—as its first inhabitants. Before long palm-

ISIS NOBILIS.

groves beautify the new creation, an army of marine birds has collected on the new place of refuge; and land-birds, which have lost their way, revel in the shelter of the bushes which grow there. Lastly, after vegetation has completed its task, man makes his appearance on the scene, builds his hut on the fertile soil, which fallen leaves and rolling weeds have gradually formed, and calls himself lord of this small world.

Thus, in the course of ages, have been formed all the islands, connected in a link or arranged in circles, which

rise upon the Coral-reefs of the tropical ocean ; thus was formed the large territory of the Maldives, whose sultan, Ibrahim, bears the haughty title of King of the Thirteen Atolls and the Twelve Thousand Islands. May his shadow never grow less, or his star set!

With a few words on the valuable Coral *Isis nobilis*, we will close a chapter which has, perhaps, grown too long. It is found in the Mediterranean, principally on the coast of Provence, from Cape de la Couronne to St. Tropez, off the islands of Majorca and Minorca, at Stromboli, and on the coasts of Sicily and Algiers. It grows in large banks on the rocky ground. Only the internal parts of the Polypodoms consist of the marbled red stony substance, which a large colony of Zoophytes cover with a softer living crust.

At Stromboli, and in the Straits of Messina, according to De Quatrefages, the Coral-fishery is carried on now just as Marsigli described it 150 years ago.

A large wooden cross weighted with stones, whose arms of equal length carry nets made of tow, is lowered on to the rocks for a depth of 200 to 300 feet. While one of the fishermen alternately raises and lowers this apparatus, his comrades row on slowly, so that a considerable distance is swept by it. Then the whole affair is drawn up, and the torn-off pieces of Coral which are found hanging in the meshes of the net are taken out. Each boat has a crew of seven or eight men, and the fishery lasts from April to June.

The quantity obtained in these parts annually amounts to about 12 Sicilian quintals, each of 250 lbs. Formerly the price of the raw material was 4s. 6d. the pound. Each bank is only dragged once in ten years, as the corals require that time to grow to perfection again. In Naples many persons live by polishing, perforating, and selling this beautiful marine production.

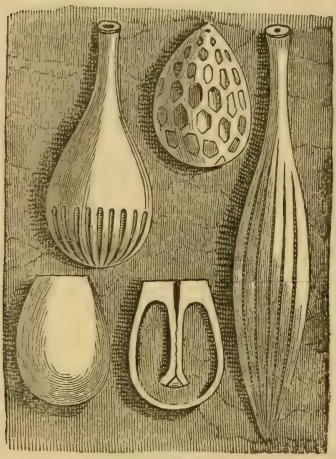
CHAPTER XI.

Do not think, dear reader, that with the enormous families of fish, moluces, jelly fish, crustaceans, and polypes, which we have brought before your notice, that Life in the Sea is exhausted, and that the salt water, or the sand on the shore, contains no further marvels for you. To the unassisted eye all this may certainly appear desolate and uninhabited; but the microscope, or even the magnifying glass, will soon teach you better, and, in the shortest space, reveal to you a new and astounding world. While walking along the beach pick up a handful of the drift-sand, which the wind has collected, and examine it through a magnifying glass: you will perceive nearly always, under the coarse grains of the inorganic silicious earth, a quantity of the most graceful forms of shell; some shaped like antique amphoræ, others convoluted like nautili or ammonites—all in their smallness so carefully carved, and formed in such a masterly way, that no human artist would be able to produce them in the same perfection on an increased size.

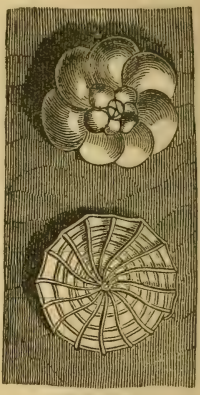
The knowledge of these pretty creatures, of these Rhizopods and Foraminifera, as they are called, may justly be regarded as an achievement of the most recent times; for it is not much more than a century since they were first discovered by the Italian naturalist, Beccaria, in the sea-sand at Ravenna. For a long period they were regarded as the exclusive product of the Adriatic: afterwards they were found here and there in England and France; their universal propagation and importance in the Oceanic Household was only proved in 1825, by Alcide D'Orbigny.

It has been conclusively shown that Foraminifera are present in the sand of all sea-coasts, and in such extraordinary quantities, that they form a material portion of

its weight. Jonas Plancus, who first drew them in 1739, counted 8,000 in six ounces ; D'Orbigny, in a pound of sea-sand from the West Indies, 3,849,000. Schultze, by a fine sieve, separated all the coarse grains from the sand of Molo di Gaeta, which is remarkably rich in the smaller Foraminiferous shells ; about one-half of the residuum consisted of well-preserved Rhizopod shells. When we learn further, that the sea-lead along the whole Atlantic



LAGENÆ.



ROTALIÆ.

coast of the States continually brought up masses of Foraminiferous shells, from depths reaching to 90 fathoms: that, therefore, along this great distance—which is, however, but a small part of the enormous territory occupied by them—they plaster the entire bed of ocean—it will be seen no animal group can, in the slightest degree, cope with them in numbers ; not even the fossil infusoria, of which 41,000 are found in every cubic inch of the stratum of Biline

polishing slate, which occupies several square miles—for they have merely a local distribution—while the Foraminifera inhabit all waters.

The similarity of their shells to those of the Nautili and Ammonites, led at first to the belief that these gracefully spiralled calcareous shells were formed by similar animals, and their smallness was ascribed to the exhaustion of a form, which no longer found the conditions of its earlier growth, in the altered state of the temperature and the components of the sea. Closer examination has, however, proved that they are animals of a very low order, which stand in close relation to the Amæba, also found in every sea. Other animals amaze us by their composite structure, the multiplicity of their organs, while each, designed for a special purpose, forms a harmonious whole; but, in the Amæba, the extremely simple structure of the body arouses our highest admiration. Nowhere do the mysteries of vital strength appear to us in a more wondrous light than in this case, where it reveals its most secret arrangements without any appointed instruments. The Amæba is nothing but an animated being, of a loose, pellucid, colourless, contractile substance, whose individual life is revealed by various changes of form, which bear the character of arbitrary motion. The larger mass of the body floats after a rounded or pointed, longer or shorter, continuation, which can grow from any part of the body: similar continuations grow afresh, and produce, by the constant change of motion, protæan alterations of form in this simplest of all animal bodies. There is no distinction between cuticle and body in them; and the movements of these beings appear acts of volition; but there are no special organs of motion and feeling in their simple forms. They cannot exist in a body whose parts are so thoroughly equivalent, that each grain can at any moment change place with another.

The substance seems not only regularly contractile, but also equally irritable at every part of the body, and adapted

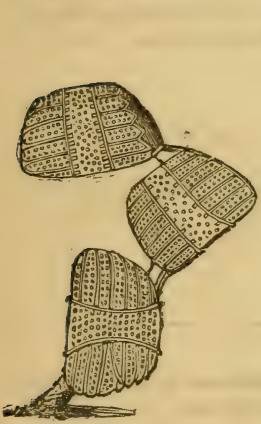
to receive food and digest it. If an Amæba draws near another small animal or vegetable organism whose movements are not sufficiently quick to escape the enemy, it spreads its many-shaped continuations round it; after surrounding the strange body, they float behind it together, and the prisoner lies enclosed in an animal substance, till all that is soluble is extracted from it.

Though the Foraminifera and Amæba have no difference of internal form, externally they differ greatly. The principal distinction is, that, in the latter, the body is naked; but, in the former, exhibits a husk on its surface, through which the soft animalcule inside thrusts forward the fleshy parts that are used for crawling or seizing prey, by means of one or more openings. The outstretched threads seem to have something poisonous in their nature; for Dr. Schultze, of Griefswald, who has written a most interesting Monogram on the Foraminifera, repeatedly noticed that small lively Paramecia, Colpodes, and other infusoria, were entirely deprived of their motive powers by any sudden contact with the outstretched net of threads.

The calcareous structures of the Foraminifera, of which 1,600 varieties are already known, are remarkable both for their prettiness and the multiplicity of their forms. They are found globular and bottle-shaped, straight and spiral; some have only one large opening, others have countless small holes all round. In some, again, the cavity is simple, in others, divided into several chambers.

The Diatomaceæ play an equally great, if not greater, part with the Foraminifera in the ocean kingdom. The forms of these strange microscopic creatures display to us regular mathematical figures—cubes, triangles, parallelograms—such as are found in no other plants; and their surface is frequently most elegantly carved. They are found in every sea. On Sir James Ross's last voyage of discovery to the South Pole, the lead was sunk in depths which would have held Chimborazo, and Diatomaceæ were regularly

brought up. The mighty ice wall which at length checked the southern course of the daring seafarers, was coloured brown by the Diatomaceæ. Floating ice, when melted, displayed them by millions. They often formed a dirty foam on the surface of the Polar Sea. The Diatomaceæ are covered with indestructible silicious husks, which explain the great geological value of both these microscopical



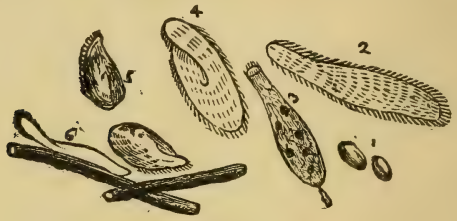
ISTHMIA.

LICMOPHORA.

creatures. Man, and all the mammals, disappear without a trace; in a short time their constituents are dissolved; while the Foraminifera and Diatomaceæ construct for eternity. Incessantly they lay their ever-increasing pavement on the ocean-bed: they are ever active in throwing up submarine mountains and banks, and filling bays and arms of the sea. At the first glance, it may appear an exaggeration to ascribe such an important part to beings which are so small, that millions are often needed to occupy the space of a cubic inch; but when we reflect in what astounding num-

bers they are found, how rapidly they multiply themselves by separation, and that, from the first dawn of animated nature to the present moment their rapidly-dying generations have followed each other, we can easily understand that they are among the greatest builders of the earth; so that the entire bed of ocean is nothing but a catacomb of Foraminifera and Diatomaceæ.

In addition, the sea is peopled by a countless number of Infusoria, which move by the assistance of floating cilia, and whose complicated organism often astounds us. This whole



INFUSORIA.

microscopic world serves as nourishment to rather larger animals, which are again swallowed by more powerful creatures; till, finally, the larger fish, the sea-birds, the mammalia, and man, feed on the abundance of ocean. Their disappearance would, in all probability, depopulate the ocean.

CHAPTER XII.

WHILE *terra firma* develops its richest plans on the lowest spots—in plains and in bottoms—and the size and variety of its growth decreases in the loftier mountainous regions, till at last all vegetation dies out, we find quite a different arrangement in the Ocean empire. Here the greatest depths are plantless, and the calcareous nullipores, mosses, and lichens, are not found below a depth of from six to eight hundred feet. Gradually, corallines and other varieties of sea-weed join them, till the rich girdle of plants which the sea displays on its frontiers commences about one hundred feet below the surface of the water. The plants which form it stand, it is true, at a lower stage of development than those of the land, and lack the splendour of the flowers and fruits; but, just as the earth ever appears in a new garb at different heights and latitudes, and attracts our highest admiration by the unending multiplicity of its ornaments, so the forms of the Algæ change, both in descending from the highest bed to the depths, and in moving along the coast; and the leaves of these marine plants are deficient neither in beauty of colour, nor in gracefulness of form.

The different media in which land and marine plants live necessarily demand equally different modes of support. The former principally employ their roots to draw nourishing essences from the lap of earth: the Algæ, on the other hand, imbibe along their entire surface the materials needed for their support, and the roots are only employed for adhesion. The peculiar constituents of the soil are very important to the land plant, for it lives partly on them; with the marine plant, it is a matter of indifference whether the ground on which it grows is composed of granite, chalk, slate, or sandstone, if it only afford safe anchorage.

Flat rocks, which are not too greatly exposed to the pres-

sure of the waves, and have numerous excavations that remain full of water at ebb-tide, are hence the favourite residence of the majority of marine plants, while the shores consisting of loose sand are equally as barren as the Arabian desert. But even on sandy coasts, large submarine meadows are sometimes found. The *Zostera marina* (Grasswrack), the only phanerogamic or flower-bearing plant of the German Ocean, is admirably adapted to attach itself to loose sand, through its trailing stalk, from whose knots or joints long roots grow out. The long grassy leaves, of a bright green and silky lustre, which move freely in the water, afford food and protection to countless animalcules and plants. In the tropical sea, the sea-grass is eaten by the turtles; and, in the North of Europe, it is used for making cheap mattresses. Large quantities are exported to England from Ostend for this purpose.

The Algæ are divided into three large groups—the green (*Chlorospermeæ*), the olive-coloured (*Melanospermeæ*), and the red (*Rhodospermeæ*), which are subdivided again into a number of families, genera, and species. On the British coast alone, there are some 370 species, belonging to 105 different genera; so that an idea may be formed from this of the richness of the Ocean botany. Thousands are already known; but of a surety as many again are waiting for their botanic name, and have never yet been gazed on by a human eye.

The Chlorosperms, or green sea-weeds, are found most frequently near high-water mark, and love to lead an amphibious life, half in the air, half under water. To them belong the silky Enteromorphæ and ribbony Ulvæ, which, at suitable spots, cover the coast rocks with the most vivid green. Very remarkable, too, is the wide geographical extension of these genera. The *Ulva latissima* (sea-lettuce), and *Enteromorpha compressa* (sea-grass) of our coast, grow on the desolate shores of the Arctic Ocean, skirt the Tropical Ocean, and extend southward to Cape Horn. But few plants

and animals possess such a flexible nature, as to accomodate itself to the most varying climates.

The group of the olive-coloured sea-weed plays, however, a far more important part in the Ocean household. To it belong both the species which, on the fall of the tide, give our rocky shores their peculiar gloomy colour, and the mighty Laminariæ (oar-weed), which, wherever they find a firm soil, form a submarine forest-belt round the coasts to a depth of several fathoms.

The small *Fucus canaliculatus*, whose small channeled stems and branches have no air-vessels, first makes its appearance on our leaving the land; it is followed by the *Fucus nodosus*, a large species, with powerful-looking stalks distending at some places into air-vessels; and by the *Fucus vesiculosus*, a gregarious plant, which covers the rocks far and wide, from one to two feet above high-water mark down to the verge of the lowest tide. Through the broad forked leaves runs a wide rib, which is ornamented on each side with numerous air-vessels found in pairs. The deepest spot in the littoral zone, or belt of rock, extending between ebb and flood, is occupied by the equally gregarious *Fucus serratus*, which is distinguished by its toothed margin leaves and absence of air-vessels.

These species of Fucus are very frequently found on the flat rocky west coast of Scotland and Ireland, as well as in Brittany, where enormous quantities were formerly burnt, and sold for the production of soda under the name of kelp or varech. At the Orkneys alone 20,000 men were engaged the entire summer in collecting and burning it. Now it is no longer employed for this purpose; as, to the great injury of the needy inhabitants of those coasts, soda is obtained more cheaply from salt; still they are employed in collecting iodine, which, of course, has not nearly such commercial value. It is also greatly used for manuring fields, some being reduced to ashes, some in a mouldering state. Thus

several ships annually visit the coast of Brittany from Jersey, to fetch cargoes of sea-weed for that island.

The largest sea-weeds of the German Ocean are the *Laminaria, saccharina* and *digitata*. The former is found in broad, leathery, waving ribbons, two to three fathoms in length; the latter in long tufts growing on stalks, three to four feet in height. These large plants are, however, but dwarfs, when compared with the gigantic Laminaria of colder regions. Only one of the plants belonging to this family is found in tropical waters; but, on the other hand, it extends to the furthest arctic limits, and increases in size and variety toward the poles. The northern hemisphere has more genera than the southern. Both in the North Atlantic and Pacific are found the Gigantic Alariæ, with leaves forty feet long, and several feet in width; and in the extreme north the Agarum Thalasso-phyllum, Costaria, and Nereocystis; the latter only found in the Pacific, while Macrocystis and Lessonia flourish mostly in the southern hemisphere.

In the numerous channels and bays of the Tierra del Fuego, the extraordinary growth of the *Macrocystis pyrifera* excites the admiration of all visitors. On every rock, Darwin says, from low water-mark to a great depth, both along the outer coasts and in the channels, this gigantic marine plant grows. It is astonishing how it can flourish beneath the mighty waves of the Western ocean, which no rock, however hard, can resist. The stem is round, slimy, smooth, and rarely more than an inch in diameter. Captain Cook tells us, in his second voyage, that at Kerguelen's land this plant attains an enormous length, although the stem is not above the thickness of a man's hand. On some of the rocks where it grows, th bottom was not found with a twenty-four fathom line. As the Macrocystis does not grow perpendicularly, but forms a very acute angle with the ground, Mr. Darwin considers himself justified in giving it a length of 400 feet and more.

The number of living things of every sort, whose existence is closely connected with that of this huge bladder-wrack, is astounding. Nearly every leaf, with the exception of those floating on the surface, is so densely covered with corallines, that they impart to it a white colour. To the flat surface of the leaves, various Mussels, Tops, Mol luscs, and Bivalves attach themselves. Countless Crustaceans live on some parts of the plants. On shaking the large tangled roots, a pile of little fish, shelled Molluscs, Cephalopods, Crabs, Sea Urchins, Asteroids, handsome Holothuriæ, Planariæ, and crawling marine animals of every possible shape, is found.

Under the leaves of this plant, Mr. Darwin also tells us, numerous species of fish live, which would find food and shelter nowhere else; if it perished, the numerous Divers, Gulls, and other fishing-birds, and the Otters, Seals, and Porpoises, would also be destroyed; and, lastly, the savage, the wretched lord of that unlucky country, would be compelled by hunger to double his cannibal repasts, and, probably, in his turn disappear from the globe.

When three days from Cape Horn, large masses of sea-weed, torn off by the storms, announce to the navigator that he is approaching the Fire-land. "We succeeded," Meyen says, "in securing one of these floating islands, which was drawn on to the deck by the exertion of five men. It was impossible to disentangle this enormous mass, and we could only trace the apparent stem for sixty-six feet. The branches were thirty to forty feet long, and as thick as the parent stem, from which they depended. We estimated the entire length of the plant at 200 feet; the pear-shaped air-vessels at the base of the leaves were frequently six to seven inches long, and some of the leaves measured seven and eight feet. On these floating sea-weed islands were a large number of the most varying animal creatures, thousands and thousands of Lepadæ and Sertulariæ, Crustaceans and Annelids.

"The gigantic plants which the mighty ocean shelters

in the vicinity of Tierra del Fuego, attracted us as much as the luxuriance of the vegetation in the forests of Brazil. A single plant of the *Macrocystis pyrifera*, with its enormous mass of leafy substance, covered as large a space of land as those giants in the virgin forests of Brazil. The number of lower Algæ, Sertulariæ, Cellariæ, and all the other animals that have taken up their abode on the floating islands, exceeds in variety the parasitical covering of the trees in the tropical forests. It seems as if in these desolate regions of the Earth, where the calmness of nature is only disturbed by terrible storms, the producing power of the planet is solely displayed in the giant growth of the submarine vegetable world."

Extraordinary masses of gigantic sea-weed, Macrocystæ, Lessoniæ, and D'Urvilleæ, are also met with on the rocky coasts of the Falkland Islands. Torn from the rocks and hurled on the coast, they collect in the surf into immense vegetable cables, much thicker than the human body, and several hundred feet long. Many of the finest and rarest Algæ may be discovered here, reminding the botanician, by the similitude of form, of his distant home, while their sight tells him at the same time that he is in another hemisphere. The giant species of the Lessoniæ are principally met with near islands. Their growth resembles that of a tree. The trunk attains a height of eight or ten feet, and the thickness of a man's thigh, and terminates in a crown, whose leaves descend like the branches of a Weeping Willow. Submarine forests are formed by this plant, which, like the Macrocystis, shelters an infinity of marine animals.

Equally rich in gigantic marine plants are the northern part of the Pacific, near the Kuriles, the Aleutian islands, and the island-studded north-western coast of America. The Nereocystis Lutkeana forms dense forests in Norfolk Bay, and at New Archangel, in Russian America. The stem of the plant, which is often 300 fathoms in length, is not thicker than a ribbon, and terminates in a large stalk

bearing a coronal of Dichotomous leaves, which reach a length of thirty and forty feet. Martius tells us that the Sea Otter, when watching for its prey, likes to rest on the air-vessels of these giants; and that the tough long stems supply the rude fishermen of those parts with excellent lines.

The growth of the Nereocystis must be extraordinarily rapid; for it is an annual, is never seen in spring, and therefore develops its enormous size in the course of a single summer.

Before we pass to the third great group of marine plants, the Rhodosperms, or Fucoids, we must refer to the enormous weed meadows or fucus-banks of the Atlantic, which are among the greatest marvels of the ocean. It is well known that the mighty Gulf Stream, which pours its blue masses of water from America to Europe, at the Azores partly turns southward again towards the African coast, and is driven back to the American coast by the north-east trade-wind. Within this limit a sea is enclosed from 22 deg. to 36 deg. N.L., and from 25 deg. to 65 deg. W.L., which displays very few currents, and those depending on the wind blowing at the time. This quiet portion of the ocean, whose surface is thrice as large as Europe, is found to be covered with larger or smaller heaps of *Sargassum bacciferum*. Some days it collects round the ship in such masses, that its progress is impeded, while at other times hours elapse before a plant is seen. When Columbus crossed this unknown Sargasso sea, his desponding comrades became still more apprehensive; for they believed that these floating beds of sea-weed, which hemmed the course of their vessel, indicated the limits of the navigable ocean.

It deserves mentioning as an interesting fact, that these fucus-banks afford us the most remarkable instance of gregarious plants of a single species. Nowhere else, neither on the grassy prairies of America, nor in the heaths and forests

of Northern Europe and Asia, is such uniformity of vegetation to be found, as in these mighty sea-weed beds.

"The collection of this enormous carpet of plants," Meyen says, "over a space of more than 40,000 square miles, has been, since Columbus's time, the object of admiration and investigation. Some navigators believe that this sea-weed is collected by the Gulf Stream, and that in the Gulf of Mexico enormous quantities grow, a supposition, however, which does not now need to be contradicted, as I shall presently show. Humboldt was of opinion, that these marine plants grow in shallow water, and are torn up by fish or molluscs; perhaps, too, by currents, and other causes. Von Martius believes that the weeds grow in shallow water at 24 deg. N.L., and 28 deg. W.L., and are torn off there by the whales. It is inexplicable to me, how such enormous masses of this plant could be torn up from isolated shallows. I have examined thousands and thousands of these roots, and I may venture to assert, that they were never sessile. While swimming in the water, they have pushed out roots and leaves in every direction. I have noticed a similar development and growth among free Algæ spores, and the formation of a root among the floating Confervæ, and hence I do not consider the growth of the sea-weed, which floats about in the open sea, as so very wonderful. According to my opinion, they have been floating about at the place where they are found for thousands of years; but their mass must increase annually, though it is difficult to explain how. I must mention here the great number of animals which find their residence and food in these floating islands of Gulf weed. The Sargasso sea is usually covered with tiny Sertulariniæ, coloured Vorticellæ, and other strange creatures. Various Pleurobranches and Nereides sit on the branches of this weed, and serve as food for the countless fishes and crustaceans which have taken up their abode here."

Similar evidences are found in the Indian and Pacific

Oceans at proportionally quiet spots, which are surrounded by rotatory currents. That their appearance is such a rarity may serve as a proof of the restless motion of the waters. If this eternal circulation did not take place, probably the sea would everywhere be covered with weeds, which would be alone sufficient to impede navigation.

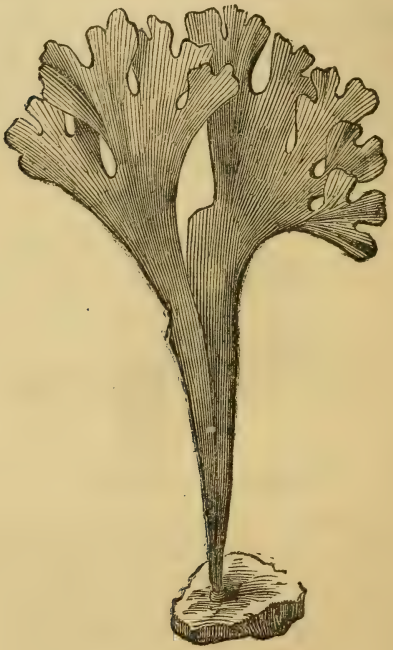
The Red Sea weeds, the Rhodosperms or Florideæ, with a short account of which we shall conclude this chapter, embrace the greatest number of species, and, though not the largest, are the handsomest in form and colour. They like neither light nor motion, and hence remain beneath the shadow and protection of the larger varieties, on the shelving

POLYSIPHONIA PARASITICA.

sides of deep hollows. Many of them grow at a depth below the tidal influence, but the majority are found on the line of low-water mark, and are only visible for a few hours during the spring tides, when the sea runs out to the fullest extent. To this group belong the wondrously-delicate Polysiphoniæ, Calithamniæ, Delessertiæ, Plocamiæ, etc., which delight the collector's heart by their gracefulness, and bright pink, scarlet, or purple colouring, as well as the calcareous Corallines and Nullipores, in which the external colouring is absent, and which were long considered animal formations,

owing to their coralline nature, but reveals their true nature by their internal structure.

Iceland Moss (*Chondrus crispus*) which is found in incredible quantities on the coasts of the British islands, also belongs to the family of the Rhodosperms.



CALITHAMNIA.

On being boiled, it almost entirely dissolves in the water, and on growing cold, becomes a colourless, nearly tasteless, jelly. The poor coast inhabitants of Ireland and England

have used it for food during a lengthened period, and it has also been introduced into the pharmacopœia in the last twenty years under the name of Carrageen Moss. Similar nourishing jellies, which can also be employed as glue, are obtained from several exotic weeds, among others from the

CORALLINA OFFICINALIS.

Gracilaria spinosa of the Indian Ocean, which the Salangane (*Hirundo esculenta*) is said to employ principally in the construction of its edible nest.

The steeply sheving walls of the south coast of Java are covered with luxuriant undergrowth to the extreme verge of land: even Pandanuses take root on the steep walls themselves, and look down by thousands into the surging sea below.

In course of incalculable years, the surf has worked deep bays and cavities in the calcareous rock: and in them the Salangane builds its nest. Where the sea rages most, flocks of them will be seen hovering. They fly purposely through the thickest foam, and seek their food in the seething surf. From a projecting peak, the orifice of the cavity, Gua Rongkop may be seen, at one moment entirely beneath the waves, and then peering out again, and the swallows

flying in and out with lightning speed. While, at a short distance from the coast, the blue sea is quite calm, it never ceases to boil and roar at the foot of the rocky walls. The most beautiful rainbows are reflected from the incessantly rising spray.

What marvellous instinct can have induced the birds to attach their nests to the high, arched, gloomy roof of these caves? Did they, perchance, hope thus to escape the pursuit of man? If they did so, their hopes were vain; for his avarice teaches him how to gain access to the most inaccessible things. At the Guagede Cave, the ridge of the coast wall is 80 feet above the level of the sea at ebb-tide: the wall bends concavely inwards, but forms a promontory 25 feet above the sea, which excellently assists the nest collectors; for they let down a ladder, made of ratan cords, perpendicularly from its edge. The roof of the entrance to the cave is only ten feet above the sea, which covers the whole of the bottom even at ebb-tide, while at the flood the opening of the cave is closed by every rolling wave. The interior can only be reached at ebb-tide with a perfectly calm sea, and even this would be impossible were not the roof perforated by a number of holes. On the projecting points in these holes, the boldest and strongest of the collectors stands, and attaches ratan cords to them, which hang down from the roof from four to five feet. To the lower end other long cords are fastened, so that it forms a hanging bridge all along the cave, following the inequalities of the roof. The cave is 100 feet wide, and 150 feet long to the extreme northern point. Other caves are 500 feet long. If we have admired the daring of the cragsmen of St. Kilda, who oscillate in the air, we must not pass by the courage of these Javanese cave-plunderers. Before they hang down the ladders to collect the birds' nests, a solemn prayer is addressed to the goddess of the South Coast, and at times a sacrifice offered at the grave where the first discoverer of the bird-nest cave is said to lie. Thus, in all zones

and at every stage of civilization, man is led by an inner voice to rely on the invisible powers, where a great and dangerous enterprise is before him. The Salangane, as we have said, builds its nest of sea-weed, which it macerates in its maw, and then expels again through the beak. The layers are continually placed on the edge of the nest till the whole is finished, and they harden in the air. When the time for the harvest approaches, a few collectors go down into the hole daily, and examine in what state the young brood is. If they notice that the young are nearly all fledged, the collecting is begun. These nests form the first quality; those with still quite naked birds, the second; while those which still contain eggs, and are not ripe, are counted as the third. On the other hand, those nests are over-ripe, black and useless, in which the young are already feathered. All the young and the eggs are thrown in the sea. The nests are taken thrice a-year; and the birds incubate four times. In spite of this huge extermination, their number does not decrease, either because many young birds have flown out before the day of execution, or other swallows come from caves that are still inaccessible. From this cave, 50 piculs are annually obtained, for which the Chinese pay from £350 to £450, or about three guineas per pound. A picul, on the average, contains 1,000 nests. If we assume each collection to produce 50,000, and calculate two birds to each nest, we arrive at a total of more than 100,000 swallows living together in the Javanese ocean-caves.

In the interior of the island, too, in the limestone grottoes of Bandong, the Salangane nestles, though in much smaller numbers, for scarce 14,000 nests are collected there in the year. In these caves, swallows and bats live together, but do not disturb each other; for when they are not breeding, the former fly out of the cave at sunrise and do not return till late in the evening. The collectors suspect that they seek the sea-beach.

In Sumatra and the other Sunda isles, birds' nests are

also collected; but nowhere in such quantities as at Java. In China, they are first cleansed of all foreign constituents by special instruments, and then taken to market. In being prepared for the table, so many spices are added that they are the greatest of Chinese dainties; but, in themselves, they are nothing but fine jelly.

The Japanese have long found out that these expensive birds' nests are only softened Algæ. Those sea-weeds which are found in large quantities on the coast of Japan are powdered by them and boiled into a thick jelly, which they pour out in long pipes like maccaroni, and introduce it into trade under the name of Jin-jan, as an artificial birds'-nest substance. The Dutch call it Agar-agar, and eat large quantities. Boiling is alone necessary to reconvert it into jelly. How great the use of this vegetable jelly must be in Japan is proved by the fact, that it is quoted as a production of the land in geographo-statistical works.

Thus we see that the Algæ, which were considered by the Romans so valueless, that, when they wished to indicate anything extremely paltry, they used to say it was worse than sea-weed cast ashore—*projectâ vilior algâ*—do not at all deserve to be thus looked down on. Man might rather be reproached because, through ignorance or prejudice, he has hitherto so little used such a rich source of nourishment, which nature offers him so abundantly on all flat, rocky coasts. For not only are the species we have instanced esculent, but several others of the most common sea-weeds in the Atlantic and German Oceans (*Fucus nodosus* and *vesiculosus*, *Laminaria saccharina*), as well as the gigantic Alariæ and D'Urvilleæ of the cold latitudes, afford nourishment. Would it not be possible to prepare cheaply the nutriment contained in sea-weed, so that it might be transported for long distances? The question certainly deserves some attention; especially at a time when the supply of the necessary provision for a growing population becomes daily more difficult.

Finally we may remark, that the higher sea-weeds require salt for their growth. In the Baltic, the number of marine Algæ is much smaller than in the open sea, whose waves wash the Scandinavian peninsula at the same latitudes. But it does not follow from this, that salt can be regarded as nutriment like water, carbonic acid, and air; but that it is rather an irritating medicine, which heightens the organic activity of the organism, much in the same way that certain salts aid digestion in the higher animals.

Most of the Algæ are covered with a thick slime, which is of great importance to their preservation, as the water can glide more evenly over them, and thus their power of resisting the storms is augmented.

The Sponges, of which fifty-six species are found on the British coasts alone, belong to the problematical creatures which stand on the border line between the animal and vegetable kingdoms, and are attached to both in turn by by naturalists. As, however, it wants both sensation and motion, we have good reasons for classing the Sponge among the marine plants.

The body of the Sponge consists of numerous horny fibres constantly intersecting each other, in which very many pointed pieces of lime are imbedded, and is traversed by a system of water-conducting canals, which commence with small pores at the surface, and pour their contents into the larger vessels. These, too, are finally discharged through larger openings. According to the observations of Dr. Grant, the water flows in through the smaller pores, and out again through the larger canals, so long as the Sponge remains alive. These constant currents supply it with the necessary nourishment, and maintain the change of substance, which these low creatures require as much as the highest beings. All the horny parts are covered with a semi-fluid viscous substance, in which the simple life of the Sponge has its residence. It is this which secretes the

firm parts, forms the real spongeous skeleton, and makes the mass larger.

Sponges are progagated in a strange way. At certain seasons, the walls of the canals are covered with countless small dots or bodies, which are the spores, or young eggs, of the sponge. As they become larger, they grow covered with cilia, and soon quit the maternal body, to flow out into the open sea. Here they swim about freely for a time, by means of the constant motion of their cilia, till they attach themselves to some fixed object, in which they can await their further development. From this moment their wanderings cease, and a quiet vegetative life is substituted for the adventurous nomadizing. From this history of their development it might seem as if the Sponges could not be denied an animal nature; but the spores of the sea-weed enjoy the same privilege of a movable life, so that this is no distinguishing mark between the animal and vegetable kingdoms. The common sea, or bathing Sponge (*Spongia communis*), which plays so useful a part in our households, is usually obtained from the islands of the Archipelago, where it is attached to reefs, and forms a considerable article of trade. The West Indies also supply useful Sponges. Burnt Sponge is still employed as an effectual remedy in cases of goitre, and owes its medicinal power to the iodine, bromine, and carbonate of lime which are found in the ashes.

We close our book with a few remarks on the dependence of all created beings on time and space.

Of the countless animal and plant varieties which inhabit the globe, each finds only at one spot of it all those climatic influences and conditions of soil combined in which its life attains perfection. Some, gifted with a more yielding or a

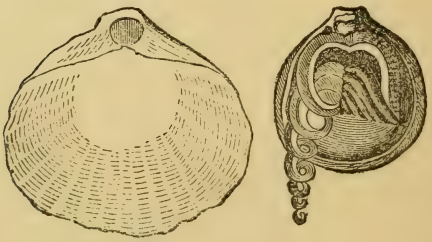
more energetic nature, occupy a wide space on the surface of the earth; they are found enjoying a healthy existence, spread over entire hemispheres. Others, again, have to be contented with their own home, and are not unfrequently limited to a single bay, a single mountain slope.

In this close mysterious connection between the producing soil and its productions, is doubtlessly hidden a great part of the magical charms of nature. Here all is harmony; we feel it in our heart-of-hearts, and our eye rejoices at the union of form and colour, as our ear does at the sound of fine music; and what creation of any human artist could be compared with the pictures, whose endless, ever changing gallery the Master of all worlds displays to us in every zone from Pole to Pole! They pass away in a second; but every minute brings new ones never before seen. Fortunate is the man who, by attentive loving observation, has gained a deeper insight of their beauties! To him every walk reveals sources of the purest artistic enjoyment.

The causes that attach animals and plants to certain localities are partially clear and patent to us. The warmness or coldness of the sea, produced by currents, geographical position and depth, quiet or troubled, pure or impure water, abundant provision or the want of it, the fineness or softness of the soil, sufficiently explain, in many cases, why various genera of marine creatures are here found in large numbers, or there are entirely absent. A glance at their structure teaches us sometimes the physical qualities which their residence must necessarily possess. We see at once if an Alga requires the protection of an unruffled calm or can defy the storm; if it is found to anchor on the rocks, or to sink its roots into a yielding soil. Many a Mollusc can only breathe in the purest water, or requires hard stone, to which it attaches itself. In other soft-bodied tribes, on the other hand, the respiratory organs are protected against the admission of shifting land, and permit them to hide from their foes in the mud.

The geographical distribution of the plants and animals found on land, is indubitably much more easily decided than that of the denizens of the sea. The inquirer can mount the loftiest mountains to the last trace of vegetation; and, far above these summits, his eye pierces the pure atmosphere, in which the Condor soars in solitary majesty; he can traverse the valleys, or, descending into the interior of the earth, even survey and collect the subterranean flora; but he cannot walk over the submarine meadows or through the thickets of the fucine forests; he is not permitted to sink into the depths of ocean.

But, in spite of these natural obstacles, his investigating mind, connected with his insatiable curiosity, has granted him means to consult the abysses and their secrets, and partly to raise the veil behind which the life of the sea is hidden. Armed with the dredge, he filches from the bottom of the sea Plants, Polypes, Molluscs, and Echino-dermata, and learns the different provinces they select for their abode; or he lowers the line for hundreds, nay thousands of fathoms, in order to draw up with it specimens of Corals and Shells.



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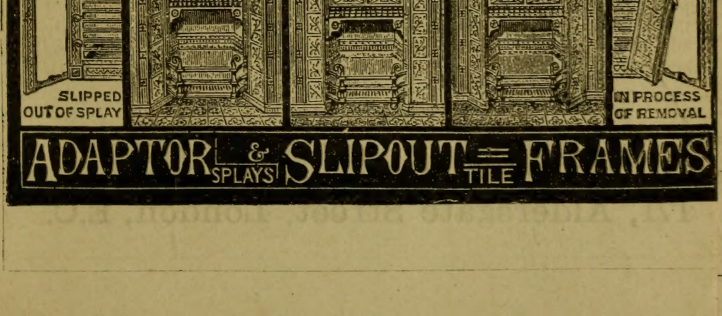
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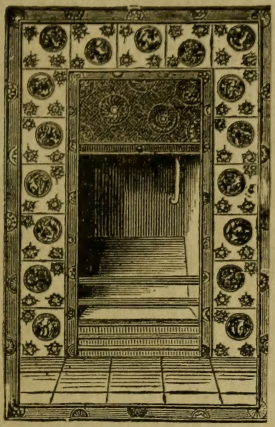

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